Light and Lighting

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Contents

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Appointment with Readers

MORE than one savant, while praising and enjoining punctuality, has conceded that it is not an easy thing to be punctual. During the war years punctuality in the publication of periodicals was certainly not easy, but, since then, though LIGHT AND LIGHTING has appeared reasonably punctually, its publication date has been too near the end of the month. Occasionally, owing to circumstances beyond our control, some of our readers have not received their copy of the Journal until the early days of the month after the named month of issue. To remove this anomaly, LIGHT AND LIGHTING will in future be published on or about the first day of each month. This advancement of the publication date might have been achieved by " skipping " an issue, or by publishing two numbers in rapid succession, or by issuing a double number. We have adopted the last of these expedients, and the present number of the Journal combines those which otherwise would have been issued separately in the months of October and November. For the future then we shall be up to date in the most literal sense of this expression.

Notes and News

On this Issue

There are one or two unusual points about this issue of LIGHT AND LIGHTING which justify some comment. In the first place, it is a double issue in order to bring about an adjustment of our publishing date, so that in future the journal will appear at the beginning of the month instead of at the end. The second point, which will be pretty obvious as readers turn the pages, is that this issue is devoted entirely to street lighting, this being the first time, as far as we are aware (not having been frightfully interested in the journal in 1908), that an issue has concentrated on one subject only. The reason we have done this is that the subject is one very much in the mind at the moment, due, amongst other reasons, to the recent A.P.L.E. annual conference and the issue of the draft code of practice on street lighting. It is not our intention to make a habit of special issues like this, as we believe rather in keeping the contents more general. We ask those of our readers who are not very interested in street lighting, and we hope they are few, to bear with us on this occasion.

Though, in this issue, most of the articles deal with our own achievements in this country, there is also a slight international flavour about it. Sam Hibben, of the U.S.A., is well-known personally to many of us and to many more for his contributions to lighting literature. His article on tunnel lighting will be read with some interest.

Though it seems that for years we have been exhorted to export or suffer a fate worse than death, it is doubtful if many of us give much thought to what happens to lighting equipment made in this country after it has been stowed aboard a vessel bound for foreign parts. We would welcome more information on this subject, but the account in this issue of what has been happening in Singapore during the past few years will meet with the admiration, and no doubt envy, of street lighting engineers at home. The achievements of the Singapore authorities under the leadership of Mr. C. C. Payne are remarkable; the quality of the street-lighting equipment to stand up to the rigorous climate in that part of the world and supplied by manufacturers in this country should not be overlooked.

Coming nearer home, we have an account, compiled from information kindly supplied by M. Gaymard, of the first exhibition of street-lighting equipment to be held in France. Also from France we have collected the picture which, for want of a better term, we who put this journal together call our frontispiece. It will be recalled that, at the I.E.S. Summer Meeting at Buxton, M. Jean Chappat, in the discussion on the floodlighting paper, spoke of the long beam system using only a few projectors, which he had recently used to some effect. Our picture shows part of the Palace of Versailles floodlighted in this way.

For the home-produced articles the full account of the papers, discussions and the exhibition at the A.P.L.E. con-

Next I.E.S. Sessional Meeting in London

The next I.E.S. sessional meeting in London will be held at the Lighting Service Bureau, 2, Savoy-hill, W.C.2, at 6 p.m., on Tuesday, November 14.

At this meeting a paper entitled "The Lighting of the New House of Commons" will be read by Mr. C. Dykes Brown. It will be recalled that the previous Chamber of the House was destroyed in an air-raid in 1941. The lighting in the new building is the outcome of co-operation between the architect, consulting engineers and lighting engineers, and contains many features of interest.

ference at Bournemouth needs no introduction. Though at this meeting the draft street-lighting code of practice was discussed at some length, and the discussion is reported in the account of the conference, we include a separate article on the code, as this document is one whose arrival has long been awaited and is one which deserves, and we have no doubt whatsoever will receive, the closest attention from street-lighting engineers and authorities.

Register of Lighting Engineers

The I.E.S. Register of Lighting Engineers has now been operating for between 18 months and two years, and we understand that the initial rush of applications has now been largely dealt with. It was announced some time ago that in future all applicants will be required to have passed the City and Guilds Intermediate examination in illuminating engineering; a minimum age qualification has also been introduced. A statement of these changes and of the intention to publish an annual Register is, we gather, given in the current issue of the I.E.S. Transactions.

We believe that these changes will help to strengthen the Register and the status of those whose names are included on it. It is most important if the Register is to survive and inclusion on it to mean anything at all that the conditions of admission should be such that only really qualified lighting engineers can expect to be included. We are permitted to disclose that up to date some 273 applications for inclusion have been considered, and so far 183 have been successful. This indicates that the Registration Board responsible for the scrutiny of applications have not taken their duties lightly, and have in mind the maintenance of a standard. We hope this standard will be raised. Some time ago we hinted that the next step may be the replacement of the inter. exam. by the final; we feel it is only the lack of facilities for holding courses for the final that prevents this alteration in the educational requirements being introduced at an early stage.

Whilst on the subject of the Register we would mention that the comment has been made to us that the existence of the Register seems to be hardly known outside the I.E.S. In particular it is thought now there are quite a number of names on the Register that inclusion on the Register should be demanded as one of the qualifications for any advertised position for a lighting engineer. We agree with both of these comments and feel that now the Register has really got going firms in the industry should make use of it. No doubt applicants for jobs are not slow in putting forward this qualification; they are entitled to do so and in the course of time firms will get into the habit of specifying that only Registered Lighting Engineers need apply. In the meantime we would strongly recommend to firms in the industry, lighting authorities, county councils, and other local authorities, more of whom, we are pleased to note, are employing lighting engineers, and, not least, the Area Electricity Boards who have vast potentialities for the employment of lighting engineers, that they make the fullest use of this qualification, which can do so much to ensure the satisfactory design of lighting installations—and the satisfaction of their customers.

New House of Commons

If things go according to plan, by the time this issue reaches its readers the new chamber of the House of Commons will have been opened or will be about to be opened. The lighting in the new House includes many points of interest and we intend to deal with it in some detail in our next issue (i.e., that to appear at the beginning of December).

Before then the I.E.S. in London and their Manchester Centre will have had opportunities of listening to and discussing papers on the subject; both meetings should attract good audiences.

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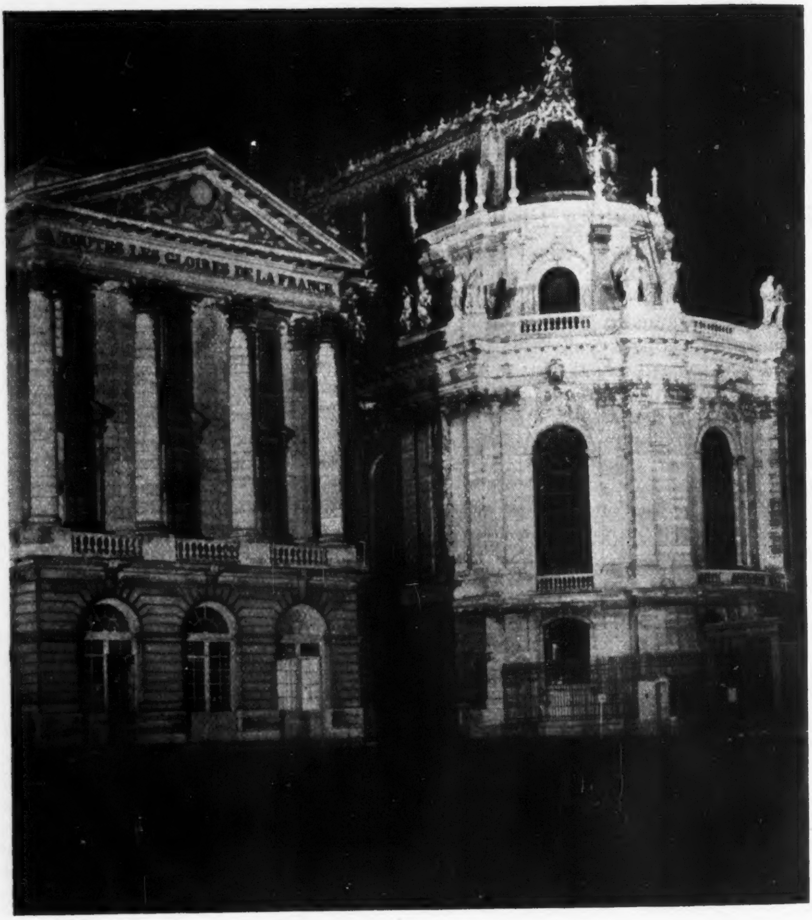


An example of floodlighting by long beam projection at the Château de Versailles, France,

A.P.L.E. CONFERENCE at Bournemouth

Report on the proceedings of the recent annual conference of the Association of Public Lighting Engineers.

The 1950 Conference of the Association of Public Lighting Engineers was held in Bournemouth from September 18 to 22. The membership of the Association is rapidly expanding and now exceeds 1,000. The attendance at the conference, including local authority delegates, street lighting engineers, and manufacturers' representatives, exceeded this number. This is the third occasion the Association has met in Bournemouth.

The proceedings began on Monday afternoon, September 18, when the annual general meeting was held in the Town Hall under the chairmanship of the retiring President, Mr. A. S. Tapsfield (London).

The result of the ballot for officers and members of Council was as follows:—

President: Mr. P. Richbell (South-Eastern Gas Board, Croydon).

Vice-President: Mr. H. Pryce-Jones (South-Eastern Electricity Board, Brighton).

Members of Council: Mr. N. Boydell (Eastbourne), Mr. L. A. Doxey (Leeds), Mr. H. Carpenter (Blackpool).

Mr. Richbell, the new President, was then inducted into the chair.

It was announced that the Council had conferred honorary membership on Mr. J. F. Colquhoun, who has retired from the position of Public Lighting Engineer in Sheffield.

At the conclusion of the annual general meeting Councillor S. A. Thomson (Mayor of Bournemouth), welcomed the Association to Bournemouth and officially opened the exhibition.

In the evening the Mayor and Mayoress of Bournemouth, on behalf of the Corporation, entertained the members and delegates at a reception in the Pavilion.

Presidential Address

Mr. Richbell, the new President, delivered his address on the Tuesday morning and devoted a large part of it to reviewing the objects of the Association, which, of course, are to promote, encourage, and improve the science of efficient public lighting and to facilitate the exchange of information and ideas on the subject. He recalled that the Articles of Association and Bye-Laws had been revised at the last annual meeting to meet the position brought about by the nationalisation of the gas and electricity industries and expressed satisfaction that the Association had been promised the full support of the Gas Council and the British Electricity Authority.

On the question of training public lighting engineers, it was stated that the preparation of a syllabus for a course in the theory, practice, and administration of public lighting has engaged the attention of the Council for some years past. The matter, however, has been held up on account of the war, but a sub-committee has been formed to carry out further investigations.

A plea was made for further financial assistance to small local authorities to enable them to improve the standard of their street lighting, especially those very small authorities who have short mileages of main traffic routes in their areas.

The president was cordially thanked for his address.

Draft Code of Practice

At the afternoon session DR. J. W. T. WALSH introduced for discussion the Draft Code of Practice for street lighting in Class "A" roads, which has been prepared by a Joint Committee of the Institution of Electrical Engineers and the British Standards Institution. He said he did so as a representative of the Drafting Committee, which was anxious to have all possible constructive comment upon the Code. He briefly outlined the circumstances which led to the preparation of the Code of Practice in preference to a specification. He said the Code was based avowedly, frankly and necessarily on the Report of the Ministry of Transport Departmental Committee which was published in 1937, the implementation of which was prevented by the war. The part of the Code which gave

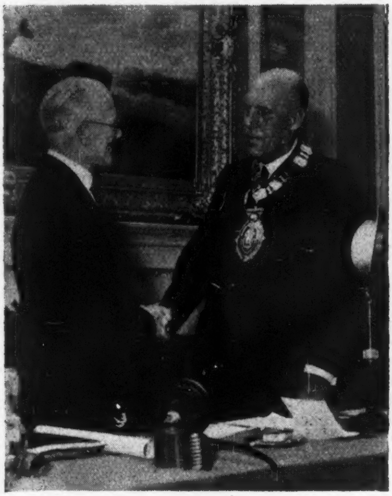
Mr. A. S. Tapsfield and members of the A.P.L.E. Council.

the Drafting Committee the greatest trouble was that which dealt with the light distribution from the fittings, and an attempt had been made to deal with this from the point of view of the road and its appearance and purpose, in Section D, and from the point of view of the lantern in relation to the man who designed it and the man who wanted to choose a particular lantern for a particular street, in Section K. He emphasised that in the past lighting engineers had spoken of different kinds of distribution by different names although meaning the same kind of light distribution, and that this caused difficulty, especially when dealing with non-cut-off installations. Thus there had been a tremendous amount of confusion, and the Committee, with the object of clarifying the position, suggested that non-cut-off installations should be divided into two, *viz.*, high angle beam and medium angle beam, although it was admitted that even this did not completely meet the situation.

Dr. Walsh briefly ran through the other sections of the Code of Practice as drafted and asked for comments from all those interested.

Mr. J. G. Holmes (Holophane, Ltd.), in a detailed criticism of the draft Code, expressed the view that the three most important items in designing a lighting installation for a given street are: (1) to put the lanterns in the right position (the most important); (2) to choose the best distribution of light from the lanterns; and (3) to choose the most appropriate colour and quantity of light. He criticised the clauses of the Code dealing with the distribution of intensity because he said he was anxious that manufacturers should not be faced with ambiguities in the Code. There was very welcome change in the section dealing with distribution of intensity, and this related to the definition of directional ratio. He had always felt that the definition in the 1937 Report bore little relationship to the effect of peakiness in the distribution which it was intended to indicate, and the definition in the Code had a more significant meaning and also was somewhat easier for the manufacturer to measure.

Whilst he had considerable admiration for the way the draft Code dealt precisely with the choice of positions for lanterns, he regretted the lack of precise guidance on several other points. Those who had to decide on a street lighting installation must consider the effects of the colour and the quantity of light and some general guidance might have been given. Designers of lanterns and lighting installations and those who had to prepare or work to specifications wanted to know the distinction between cut-off high-angle and medium angle, and in this connction he asked for precise definitions. Further, he would welcome some guidance on the merits of a broad spread of light compared with a narrow beam, and on the technical problems associated with the use of fluorescent lamps. In the course of his remarks Mr. Holmes drew attention



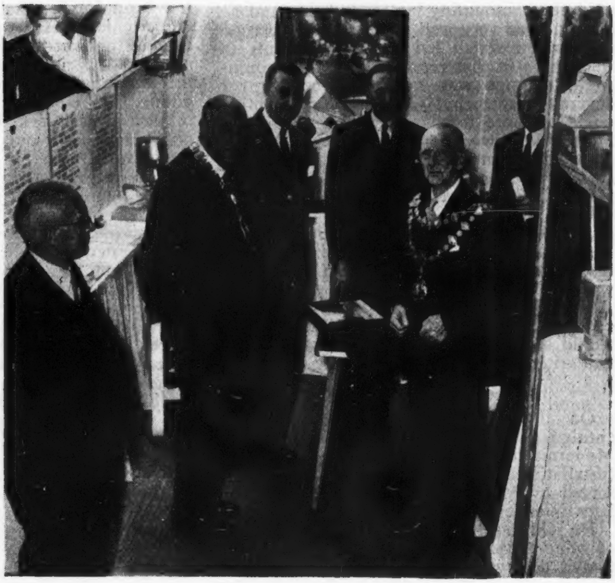
to the summary of the French Code of Practice given in LIGHT AND LIGHTING (June, 1950) and the comments upon it.

MR. C. R. BICKNELL (Siemens Electric Lamps and Supplies, Ltd.) criticised the suggestions in the draft Code for reducing the spacing between lamps, and said they would have the effect of increasing the cost by 20 per cent. He said there were many excellent examples throughout the country of 150 ft. spacings, and he saw no reason to reduce that to 120 ft., as suggested. Therefore, he asked the Drafting Committee to reconsider this matter, having regard to the economic circumstances at the present time.

MR. R. R. H. MATTHEWS (North-Western Electricity Board) disagreed entirely with the statement in the Code that it was not necessary to include in the Code definitions of terms which are in common use among lighting engineers. In different parts different meanings were attached to the words "lantern" and "lamp." In some cases a "lamp" was intended to include the whole fitting, whereas in others that was not so. The Code of Practice had also steered clear of mentioning the term "street lamp," and it was necessary to have a precise definition of that. Again, reference was made to burning hours, but should not the reference be to lighting hours.

MR. C. C. SMITH (Liverpool) also asked for a clear definition of high angle and medium angle beams and suggested there might be a third definition, that of a low angle beam. Whilst the directional intensity ratio might give some indication of the degree of glare in high angle beam lanterns, he did not think it gave sufficient indication of how little glare there was with a cut-off lantern. Reference was made in the Code to this distraction which might be caused to drivers

(Above) Mr. Tapsfield, retiring President, handing over to Mr. P. Richbell.



(Right) The President and the Mayor of Bournemouth at the stand of William Sugg and Co. Ltd. at the exhibition.

through glare from a dual carriageway installation owing to the number of sources in the driver's field of view, but in Liverpool there were dual carriageway installations which did not suffer from this defect and there was excellent lighting for both carriageways.

Mr. R. Parker (Aberdeen) thought most people would have very little quarrel with the fundamentals of the Code and could only criticise it on points of detail. He had always maintined that street lighting could not efficiently be carried out unless the engineer was well experienced in the work; hence it was essential to get on with the educational side. He thought more attention should have been given in the Code to the lighting of service roads alongside traffic routes, although it might be that the drafting committee had thought this would be better dealt with in connection with Class "B" roads later on. No reference had been made to whether or not there should be a reduction of street lighting at, say, midnight, about which there were varying opinions. The committee should have made it perfectly clear what was their opinion on this vital matter. His own view was that if an economic installation was designed and it was then practically chopped in half by cutting off most of the lighting at midnight, the result must be disastrous to the streets concerned.

Mr. J. M. Waldram (General Electric Co., Ltd.), recalled that in the departmental committee's report of 1937, quite a little was said about mounting lamps centrally and he remembered very well the experimental road in London which led to the comments in question. In that report the central mounting of lamps was rather deprecated, for several reasons, but with cut-off in lighting some of those reasons were not now valid. He thought there may be a tendency for this form of lighting to be extended, but advised that due care be exercised.

Mr. J. F. Colquhoun emphasised that the salaries paid to street lighting engineers are not sufficiently attractive to induce young engineers to take up the profession and he urged that serious consideration should be given to this matter.

Dr. Walsh briefly commented on the discussion and said the drafting committee would seriously consider all the suggestions and criticism that had been made.

Gas Installations

On the Wednesday morning a paper entitled "The Design of New and the Modernisation of Existing Gas Lighting Installations for Group B Roads" was presented by Mr. T. A. Beecroft, Distribution Superintendent to the Southern Gas Board.

He said that the importance of the lighting of minor roads had not received the attention it deserved and said that the basis for any planning must be the acceptance of the final report of the Ministry of Transport departmental committee. Some lighting engineers were at variance with the recommendations of the Ministry of Transport departmental committee's final report because it does not, and is not intended to, specify any particular illumination figure at any defined test point. The author suggested a method of assessing the distribution of a particular installation without reference to illumination value.

The author then gave illustrations of the modernisation of existing gas installations with details of the improved illumination obtained. At the same time emphasis was laid upon the need for adequate maintenance of all street lighting installations and of the unfortunate retention in service of many lighting installations which are obsolete and which may convey to the public a wrong impression of the effect to be obtained with modern gas street lighting equipment.

Discussion

Mr. E. S. Harris (North Thames Gas Board), who opened the discussion, said the Drafting Committee would perform a great service if they defined precisely what is expected of a Group "B" installation. There were many existing installations of gas and electric street lanterns which had been giving useful service over a long period of years but which could be brought up to date and made effective at relatively low capital expenditure. The substitution of modern lanterns would also reduce both running and maintenance costs. Such progress had been made by manufacturers in the development of gas street lanterns combining high efficiency sources with lanterns of pleasing modern design that it was now possible to carry out improvements to these installations on a more simple and economical basis than in the past. Referring to the figure of 40 per cent. mentioned in the Code of Practice for Group "A" roads as a permissible allowance for depreciation, he suggested that where lighting provided is of a lower order than for Group "A" roads, the depreciation allowance should be correspondingly lower.

The modern multiple mantle gas light source, with its controlled gas supply, depreciated remarkably little in service, partly because the mantles on any one burner would usually be at different stages in their life, as their replacement was required only when they were broken. In practice, however, the main factor affecting the light output of a gas lantern was the accumulation of dirt on the glassware. As the result of a number of practical illumination tests under various conditions of weather, etc., it had been found that the total depreciation of these lanterns due to all causes, but primarily

to the accumulation of dirt, was well within the required 40 per cent., even though no maintenance whatever had been carried out on the installations over a period of five or six weeks. Therefore, whatever the source used the arrangements made for regular cleaning of street lanterns was a subject of the greatest interest to the purchasing authority, and it became a question of balancing the attainment of a reasonably high standard of duty from the lanterns with economic maintenance. Attention to modern gas lanterns at intervals much greater than those employed in the past would amply meet the proposals of the Code of Practice now under consideration and would still leave the gas sources with a constancy of performance which compared favourably with its rivals. To obtain every possible economic advantage from these facts control equipment for gas lanterns had been developed so that clock winding was necessary only at similar long intervals as for cleaning, and the operation of tappet setting had been made completely automatic by the use of the solar dial.

A. Boereboom *(Belgium)*, E. C. Lennox *(North Eastern Electricity Board)*, L. Gaymard *(France)*, F. X. Algar *(Eire)*, M. Desirant *(Belgium)*.

Mr. F. Graham (South Eastern Gas Board), agreed that a depreciation allowance of 40 per cent. was too large and expressed the hope that in the Code of Practice promised for Group B roads consideration would be given to the various factors which go to maintain a street lighting installation. The manufacturers had done a very good job of work in this connection for many years and although maintenance had been left in the background hitherto, it was really the most important matter.

Mr. A. L. Williams (Bombay), spoke of the different conditions that prevailed in tropical countries and of the difficulties encountered there with tree-lined roads. Central suspension was more or less essential as the trees were necessary to provide shade during the day time. In Bombay the street lamps were cleaned every day, and he added that he was subject to severe penalties if gas mantles failed.

Mr. R. Parker (Aberdeen) criticised the author for starting with the assumption that the Report of the Ministry of Transport Departmental Committee was sacrosanct and must not be departed from in the least. For instance it seemed to be assumed that the mounting height of 15 ft. must not be exceeded in any circumstances, but there was a strong case for 16 ft. or 18 ft., with overhang. He had this in Aberdeen and 15-ft. high double-deck buses could be used in roads so lighted.

Mr. J. R. Brodie (Ayr), said that whilst this paper would have made an excellent contribution to a Conference years ago, he felt that there was now no case for gas lighting of streets. In Scotland the authorities had been converting from gas to electricity for many years, and he considered that in this respect Scotland was far in advance.

Mr. F. C. Smith (North Thames Gas Board) said that if the last speaker would do him the honour of paying him a visit he would take him to some areas in London where some of the largest municipalities still thought that gas could do a good job of work in regard to street lighting. Admittedly, both illuminants could do a good job of work, but he asked even those in Scotland to keep an open mind and see what was really being done with gas for street lighting. Reference had been made to Hyde Park, and he would ask the critics what they would have done in those particular circumstances. The park authorities would not have the existing columns changed, and in view of the circumstances he considered that what might be regarded by some as old-fashioned and obsolete gas had done an excellent job of work.

Mr. G. Berry (Borough Engineer, Coventry) said the Gas Board serving Coventry had decided—and he believed it also applied to other Gas Boards—that it was no longer interested in the supply of gas for street lighting. With gas at 11½d. per therm, which he regarded as an enormous price, there was clearly no future for it for street lighting in Coventry.

Mr. H. D. S. Lowe (Borough Engineer,

H. P. Walker and W. E. Harper *(I.C.I. Ltd.)*, E. B. Sawyer *(Lighting Service Bureau)*, T. Catten *(Falk, Stadelmann, Ltd.)*, and M. W. Hime *(South Eastern Electricity Board)*.

Chorley) said that whilst a good case could be made out for electricity from the point of view of efficiency and economy, the great drawback was the cost of conversion from gas.

THE AUTHOR, briefly replying to the discussion, said the gas industry for a long time had felt that it had been too generous as regards depreciation. He emphasised that the conditions in tropical countries were very different from those here. The economics of the problem mentioned by Mr. Berry and Mr. Lowe was outside the scope of the paper.

Street Lighting as an Amenity

In the afternoon a paper was represented by MR. E. B. SAWYER, of the E.L.M.A. Lighting Service Bureau, on "Street Lighting as a Public Amenity."

The author emphasised the need for harmonising public lighting with the surroundings, as well as providing good visibility. A special application of public lighting deserving of consideration was the contribution it could make to the enjoyment to be obtained at health and holiday resorts.

The introduction of the hot-cathode fluorescent lamp had opened up a new vista of opportunities for interior and exterior lighting. It was no secret that some lamp technologists at first thought that the size of the source and its characteristics might be unsuited to outdoor operation. After careful study, however, it was realised that this was far from the truth, for by using new materials in lantern construction it was found that it operated reliably in all climatic conditions and the length of the lamp and its low brightness made it a most desirable street lighting medium. From the point of view of appearance, the size had not been detrimental, for the larger lamps have in general been installed in central and shopping areas where the surrounding buildings are sufficiently massive to keep the proportions acceptable.

Dr. Hopkinson's work on discomfort glare (Trans., I.E.S., Vol. 5, No. 1, 1940) had enabled the street lighting engineer to add greatly to the acceptability of street lighting. Hopkinson showed that discomfort glare at any given road brightness is reduced by (a) ensuring that the lantern intensity in the direction of the observer is a minimum, i.e., using the most effective distribution of light for the purpose, or (b) increasing the flashed area of reflector or refractor.

Stressing the importance of co-operation with the civil engineer to obtain suitable road surfaces, the author said it has been found that the average brightness of different road surfaces with the same lantern can vary by as much as 3 : 1. This also accounted for the greater comfort of fluorescent street lighting installations when the roads are wet compared with other systems.

Remarking that restrictions are irksome, it was emphasised that they may in some circumstances prove beneficial to a community. For example, one might welcome a regulation to compel the removal of some of the monstrosities which line our streets under the guise of street-lighting columns. In fact, a tidying up of street "furniture" generally is long overdue. To-day, there is no dearth of designs by experienced industrial designers of both lanterns and columns and this standard equipment, if properly selected, will harmonise with the general design of buildings and the nature of the thoroughfares.

Co-operation between planners and lighting engineers should make it unnecessary to incur the expense of special equipment for those installations where the lighting is purely utilitarian. Where, however, there are special requirements, such as important city centres and seaside promenades, there is much to be said in favour of the lighting fittings being placed well above the normal line of vision, even up to 45 ft. The scale of the fittings then becomes such that high wattage lamps or numbers of fluorescent lamps can be used without assuming overwhelming proportions.

At Newton Aycliffe three 30 ft. masts, each with three 250-watt mercury lamps are used and sufficient light is provided over the

shaded area of the plan to enable a small wrist watch to be read quite easily.

The paper dealt with costs and, pointing out that street lighting at present costs an average of less than 9d. in the £ on rates, the author suggested that a modest increase in this figure would be sufficient to finance a very greatly improved installation where the illumination is poor. The increase might be more readily acceptable if publicity were given to the value of good street lighting, and demonstration sections were put in to show the advantages which would accrue from its general adoption. Criticism is made of the fact that only £80,000 is provided in the way of grants for lighting trunk roads.

The comment was made that when the motorist has to drive through a series of installations of ever-changing light sources or systems he becomes bewildered and the conditions are dangerous, especially in poor climatic conditions. (In this connection a coloured diagram was shown of the many different lighting installations encountered on the North Circular Road.)

Of the pedestrian, it was said he requires an installation, broadly speaking, which is an asset to the appearance of the locality. He dislikes an assembly of bulky columns that take up a large part of the pavement and at night he wants the streets lighted in such a way that they add cheerfulness and enable him to see his way about. He likes light on the front of his house with the rest of the street pleasantly lighted so as to remove dark places in which undesirables may lurk.

As to the visitor, special columns and lanterns can add much to the pleasure to be obtained from the gardens and walks which form a feature of so many holiday and health resorts. The lighting of promenades should be primarily for the pedestrian. The need is for higher values of illumination rather than high road brightness, for the principle of silhouette vision does not apply. (The author exhibited a number of ornamental lighting fittings for special purposes to add point to the argument that street lighting should be regarded as a public amenity.)

LIEUT.-COMMANDER E. J. COOK (North-Western Electricity Board) reinforced the argument that small local authorities having lengths of main road in their areas should be financed by the Ministry of Transport or from the Road Fund. In many of these cases an increase in the rates of 1s. in the £ would be necessary to maintain Class A lighting.

CLLR. H. EASTWOOD (Manchester Corporation) said that street lighting engineers should be given the fullest possible freedom to develop their own individual ideas and they should be paid decent salaries.

MR. T. V. BURROWS (Borough Engineer, Cambridge) said that after listening to the paper he was inclined to feel that lighting engineers were rather going over the rails especially after seeing the exhibits which had been arranged in connection with the paper. Were they not trying to make public lighting systems too conspicuous, and whilst the author had mentioned that there were many monstrosities in the streets which should be removed, he personally felt that a good many could be seen in the exhibition of lamp columns outside the Town Hall! Whilst the paper had dealt with public lighting as an amenity he felt it was also necessary to consider the amentities of public lighting.

MR. G. C. SMALL (East Midland Electricity Board) thought the author had presented a rather misleading picture in his comparison of running charges. The only way to get a fair comparison was to decide on the approximate number of lumens required per 100 ft. of road and then, knowing the efficiency of the lanterns, to apply the usual formula. That would give a rather different picture from that given in the paper. He pleaded for greater co-operation between the manufacturers of lanterns and columns in order to ensure better aesthetic properties and said there were examples in the exhibition where the lantern seemed more an appendage to the column than part of it.

MR. C. O. INNES-JONES (Borough Engineer, Leamington) suggested that more attention should be paid to the daylight appearance of public lighting columns. There were some roads on which the public

O. L. Goldsmith *(G.E.C.)*, H. Walker *(I.C.I. Ltd.)*, C. W. M. Phillips *(B.T.H.)*.

Column-erecting demonstration carried out by Erecon, Ltd.

On the general question, he said he believed that street lighting would ultimately come entirely within the province of the electrical industry. He expressed the hope that something might be done to improve side-street lighting before and during the Festival of Britain; the greater part of side-street lighting was reminiscent of the eighteenth century and should not be tolerated in the twentieth century.

Mr. Sawyer, replying to the discussion, urged that the point with regard to financial aid to the smaller authorities, especially those whose areas contained lengths of main roads, should be pressed to the fullest extent. He said his comparisons of costs were relative and were more or less comparable figures, based on an indication of what the different systems of lighting would cost. There had been no attempt to emphasise one particular system of lighting and make it appear more attractive than another. He had no wish to enter into the controversy of aesthetics, and on this point had merely put forward suggestions as to what pleased him.

lighting installation in daytime gave the appearance of a pine forest that had been attacked by blight! Greater attention should also be given to the colour of the columns. Concrete columns were now being used to a greater and greater extent, and their colour should be made to blend more with the surroundings.

Mr. E. C. Lennox (North-Eastern Electricity Board) emphasised that expenditure on street lighting throughout the country had not increased greatly during the past large number of years. Moreover, full advantage had not been taken of the more efficient units and cheaper electricity that were now available. This did not lie in obtaining more light for less money; these more efficient units should be used to their full advantage to get more light on our highways—and that was surely needed. The allocation on the financial side from the Ministries towards public lighting was an old subject which he had often criticised, and it remained a matter on which administrative action should be taken in order to relieve those small authorities who could not afford to carry out main street lighting to the required standard.

Mr. V. W. Dale (British Electrical Development Association) suggested that a good way to get some improvement in the design of street lamp columns was for some organisation, perhaps E.D.A., or preferably the A.P.L.E., to organise a competition with a prize of, say, £1,000. That might result in getting something really revolutionary.

Road Safety

"Some Problems in Road Safety Connected with the Lighting of Streets" was the subject of a paper on the Thursday morning by Mr A. J. Harris, of the Traffic and Safety Division of the Road Research Laboratory.

This paper is the first to be presented to the Association by a member of the staff of the Road Research Laboratory, and one of its objects was to introduce the laboratory to the Association by giving a brief description of it and its work on road safety. The laboratory was originally set up by the Department of Scientific and Industrial Research for research into materials and methods of road construction. It was not then concerned with safety on roads nor with other aspects of their function as traffic arteries. It was not until 1946 that the terms of reference of the laboratory were enlarged to include both road safety and traffic flow and that the organisation began to assume its present form.

The work of the laboratory now falls into two parts. There are, first, a number of researches from which useful results may be expected comparatively rapidly, such as brakes, slipperiness of the road surface, vehicle lights and the elimination of dazzle, the design of driving mirrors for improved

visibility, and the improvement of pedestrian crossings to make them more conspicuous to pedestrian and driver alike.

From the long-term point of view, there are problems affecting traffic flow, vehicle performance, and road-user behaviour, how these are related among themselves, and how they affect the type, number, and severity of accidents. In many of these researches it is appreciated that one of the problems is to discover which are the factors that are important and how to measure them. In street lighting, for instance, it is pointed out that the method of assessing visibility satisfactorily under all conditions has still to be discovered.

The Lighting Section of the Laboratory deals with vehicle lighting as well as street lighting, but up to the present more attention has been given to the former. It has studied the problem of seeing with vehicle lighting under the conditions of glare, testing different beam distributions and studying the effect of varying the candle power and the speed, with the aim of finding the type of lamp which shall give the best seeing and a minimum of discomfort. Some work has also been done on the design of fog lamps. In the field of street lighting there are the long-term problems of relating the accident situation to the quality of the lighting and of finding a satisfactory measure of the visibility in a lighted street. Work is being done on the reflection properties of road surfaces. The demand of the road engineer for a non-skid surface will have to be reconciled with the lighting engineer's demand for a surface which shall not waste most of the light which his lamps throw upon it. Also included in the research are the lighting of roundabouts, junctions, dual carriageways, signs and obstructions, but it has not been possible to commence work on these yet.

The problem of revealing power is discussed at some length, and the original work of J. M. Waldram in this connection is mentioned. (Trans. I.E.S., 1938, 3 (12), 173-186.) Revealing power is regarded by the author as a very useful starting point towards finding a satisfactory way of assessing visibility in lighted streets.

The Laboratory has devoted a good deal of attention to devising a type of surface-marking for pedestrian crossings which can be recognisable at a greater distance than the studs or beacons which are now an essential part of any pedestrian crossing, and a number of different patterns have been examined. The general agreement was that the "zebra" type of marking, with alternate black and white longitudinal stripes 2 ft. wide, was the most conspicuous. No advantage was found in the use of other colours. No marking was found to be really satisfactory in street lighting, but the best results were obtained when the "zebra" marking was as bright as possible, particularly if illuminated by a floodlight above the crossing, the extra light being confined to the area of the crossing itself. This type of marking was, in general, seen at greater distances than studs or beacons.

A floodlight was set up in Slough High-street mounted at the side of the crossing at a height of about 20 ft., and illuminating only the area of the crossing. The illumination at the centre of the crossing could be raised from very low values to 10 lumens per square foot, and it was concluded that an illumination of about 5 lumens per square foot, was enough to make the Slough crossing recognisable from a distance of 400 to 500 ft., though in better lighted streets this would probably be inadequate. There was also a tendency for the crossing, when seen from a large distance, to appear as a plain white band across the road, the contrast between black and white not being at all conspicuous. Model tests demonstrated the importance of the dark areas of the marking, and a method was devised of reducing the reflection factor of the dark areas, mainly by roughening them.

Difficulties were experienced, however, in wet weather, and an attempt has been made to modify the reflection properties of the white surfaces also, so as to devise a crossing which shall be as efficient in the wet as in the dry, and be suitable also for conditions of poor lighting. This consisted of cutting parallel convex ribs running in the direction of the street. Whilst the visibility of the crossing was often improved under wet weather conditions, it was far from perfect.

The general effect of the "zebra" crossings, so far as the pedestrian was concerned, was satisfactory, although it was found that women respected the crossing better than men, and children were better than either.

An experiment to find out whether a lighted beacon or a floodlit "zebra" crossing was more effective did not give conclusive results; both appeared to improve observance of the crossings by about the same amount.

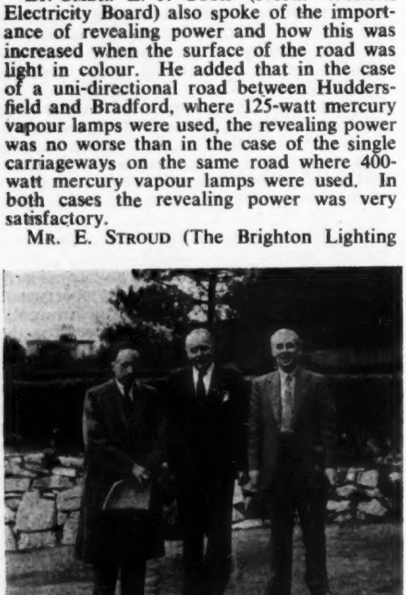
Mr. S. R. Geary (Royal Society for the Prevention of Accidents) said a material cause of accidents during hours of darkness was foreground brightness. The driver was badly blinded by the glare from the open lights, which seemed to be most popular for street lighting, and the blackness of the kerbs in consequence created considerable difficulty. Some authorities were not in the financial position to install the newest forms of electric lighting which eliminated this defect, but some means should be found of preventing glare. Another handicap to drivers was the tiring effect of having to pass through areas with varying intensities of lighting.

Mr. J. M. Waldram (General Electric Co., Ltd.) welcomed the work being carried out by the Road Research Laboratory on the problems of street lighting. He reminded

the author, however, that the problem of glare had been exercising the best brains in the lighting industry for the past 30 years all over the world. It was interesting to note that the author had turned attention to the important aspect of revealing power, for visibility in our streets was a quality which seemed to elude measurement. The most important factor was that the extent to which objects could be seen on the road depended on the ratio of the brightness of the road to the amount of light put on the object, and it would be a very good thing if the Laboratory would concern itself with both surface and lighting. He was not sure that the significance of the reverse silhouette, i.e., the case in which the object turned up as a light object on a dark ground, had been fully appreciated, and the aim should be to design street lighting so that this reverse silhouette effect did not occur. The point was that if the brightness on a completely black object was gradually increased, when it got to about half the brightness of the background it became shadowy and indistinct and was not clearly revealed for the driver's purpose, and if the brightness of the object was still further increased, it disappeared altogether.

LT.-CMDR. E. J. COOK (North Western Electricity Board) also spoke of the importance of revealing power and how this was increased when the surface of the road was light in colour. He added that in the case of a uni-directional road between Huddersfield and Bradford, where 125-watt mercury vapour lamps were used, the revealing power was no worse than in the case of the single carriageways on the same road where 400-watt mercury vapour lamps were used. In both cases the revealing power was very satisfactory.

MR. E. STROUD (The Brighton Lighting and Electrical Engineering Co., Ltd.) recommended the author to take up the question of the alteration of the distribution of the light. Personally he was of the opinion that glare was the biggest factor in creating danger on the roads, and if glare could be prevented, then the whole problem from the safety point of view was solved. There should be closer spacing and lower intensities, and he asked the author, in due course, to prepare revealing power curves which took into account differences in light distribution as well as the factors of reflection, road surfaces, etc.



MM. Gaymard and Cohu *(France)*, and Mr. J. G. Holmes *(Holophane)*.

MR. N. AXFORD (South Western Electricity Board) referring to the lighting of pedestrian crossings, said that floodlighting had been adopted at important crossing in Plymouth for two years. The "zebra" type of crossing, with black and white markings, was used. One 300-watt lamp, 6 ft. out from the kerb on each side, was used in a deep cut-off symmetrical fitting and with an average of 2 lumens per sq. ft., the crossings were well shown up, and the public used them. He asked for information as to the degree of contrast there should be between the illumination of the crossing and the illumination of the rest of the road; also, would the use of colour in the lighting of the crossings be an advantage.

MR. C. C. SMITH (Liverpool) suggested that the need in street lighting was a fairly high background brightness and a low brightness of the object. Monochromatic sodium lighting, whilst giving a fair background illumination, did not show the pedestrian up in his true colour, but as a rather drab-looking object, which was what was wanted to enhance the contrast.

CLLR. W. D. REID (Aberdeen) thought the author had struck a false note in his paper in regard to the manner in which his investigations of the people using the crossing had been compiled. These investigations seemed to have ignored altogether whether there were pedestrians or not on the crossings dealt with, and in his view statistics compiled in that way had no meaning whatever. He asked for a definite ruling from the authorities as to what car drivers should do in regard to crossings. At present the ruling was that a driver should stop "if necessary."

CLLR. J. J. JONES (Newcastle-under-Lyme) expressed the view that the Road Research Laboratory had found the answer to the problem of safety on the crossing in the "zebra" marking. It had been tested at Plymouth and also in Newcastle-under-Lyme with great success so far as daytime was concerned, and he suggested that lighting the beacons at the sides of the crossings should meet the situation at night. The author mentioned this in the paper but had not carried out many experiments with this form

of lighting, and it would be interesting to know why.

MR. E. R. KNIGHT (Borough Engineer, Fulham) said he was not at all convinced that the "zebra" crossing was the real solution, and he disagreed that visibility of them at 100 yards was any criterion of the effectiveness of this form of marking. In urban areas there were very few crossings which could be seen 100 yards away, for physical reasons, quite unassociated with either lighting or colour. There would be an advantage in illuminating the beacons as long as there was sufficient contrast between that lighting and the general lighting of the road to attract attention.

MR. F. C. SMITH (North Thames Gas Board) welcomed the advent of the Road Research Laboratory and its approach to the street-lighting problem. Commenting on the criticisms that certain aspects of the problem had not been investigated, he asked the critics to sit down and make a list of the variables that entered into this most difficult problem. They included the level of street lighting, the character of the distribution, siting of the lamps in relation to the geometry of the road, the objects that had to be revealed, the variation in background which a moving vehicle had to contend with, and so on. These were only a few. There was also the age of the road-user, his state of alertness and the state of his health or how preoccupied he was. All these physiological and psychological factors were of great importance in considering accident prevention. It was owing to the complexity of the problem that the Road Research Laboratory had adapted the statistical approach but that, in the hands of the inexpert, was a very dangerous weapon. It was possible to draw incorrect conclusions from improperly sampled or improperly carried out statistical investigations.

THE AUTHOR made some brief comments on the discussion. He made the point that many of the matters that had been mentioned as requiring investigation had not been considered because the Laboratory had not been working on the problem for very long and the staff was severely limited. A great deal of work was in course of progress. but it was always desirable to have some evidence before publishing anything about it.

Acrylic Plastics

The final paper at the Conference was presented on the Friday morning and was entitled "The Design and Performance of Acrylic Plastic Street Lighting Equipment," the authors being Dr. W. E. Harper, P. H. Collins, and H. P. Walker, of the Plastics Division of Imperial Chemical Industries, Ltd. The paper was accompanied by a number of demonstrations showing the properties of this material.

The authors point out that one of the

E. H. Skinner *(South Eastern Electricity Board)*, H. Pryce-Jones *(South Eastern Electricity Board and Vice President A.P.L.E.)*, and A. E. Morgan *(London Electricity Board)*.

significant post-war trends in the design of street lighting equipment has been the increasing use of enclosures and optical components made from the acrylic plastic, polymethyl methacrylate, better known under its trade name of "Perspex." Used first in the construction of interior lighting fittings, it became apparent that this material had properties which would be valuable in some street lighting units, the most important of these properties being (1) excellent optical characteristics; (2) freedom from weathering and corrosion attack; (3) light weight combined with good strength and resistance to shattering; (4) freedom from fracture by thermal shock; and (5) ease of fabrication and moulding.

The development having reached an advanced stage, with the material established and tested, the authors thought it opportune to summarise the design data gathered during the development period of three years and to review its application in modern acrylic lanterns.

It is emphasised that the properties of this material and glass are not in all respects, as has often been assumed, similar. Indeed, the optical properties are almost the only ones which these complementary materials have in common, their mechanical and thermal behaviour being quite different. Methacrylate is a comparatively new material, and equipment must be designed with an understanding of its physical characteristics and of the methods of fabrication applicable to it. The paper studied in detail only those design factors

E. B. Sawyer *(L.S.B.)*, C. W. M. Phillips *(B.T.H.)*, W. T. Savage and C. P. Banham *(Edison Swan Electric Co. Ltd.)*.

related to the thermal, optical, and mechanical characteristics.

As regards the thermal properties, it is pointed out that attempts have been made to improve these, but so far increased temperature resistance has only been achieved at the cost of degradation of other properties. An outside surface temperature of 70 deg. C. should be taken as the normal limiting operating temperature. To provide guidance for designers a series of tests have been made which, somewhat arbitrarily, are divided into radiant heat tests and convected heat tests.

To reduce the experimental work to reasonable proportions, it was necessary to select one basic shape made in a limited number of sizes operating with a limited number of lamps. The shape selected for the test with sodium vapour and H.P.M.V. lamps was a half cyclinder, 24 ins. long, bends being formed with ¼ inch sheet with outside diameters of 4 ins., 7½ ins., 9½ ins., and 12 ins. Data is given in the paper which it is claimed will enable designers to fix the safe minimum size of enclosure which can be used with any given lamp, provided the shape can be related to the simple cylinders used in these tests.

In the case of convected heat, the conditions are more variable than those produced by radiant heating, and designers are warned to use the test results given in the paper with caution. They provide limited general guidance, but should always be supplemented by tests made on the actual fitting.

Two other matters related to the thermal design of components are specially mentioned. In contact with metal housings, methacrylate housings may be overheated locally by conduction, with consequent distortion. To prevent this, it is often convenient to cement an absorbent gasket, such as cork, to the shaping, using an acrylic cement. Methacrylate has a high coefficient of expansion compared with metals, and allowance must be made for such expansion if stresses set up by thermal expansion are to be avoided. It is unwise to clamp the shaping rigidly to a metal housing, and where possible a floating mounting should be used. In any event all bolt and fixing holes should have sufficient clearance to allow free movement of the shaping as it expands or contracts with change in temperature.

As regards optical design, the authors state that developments in the design of methacrylate refractors have so far been limited to the production of prismatic plates for use with line sources. Many of the principles are, however, applicable to more complicated components such as bowl or dish refractors.

The design of refractors in this material is bound up with methods of manufacture, and two techniques have been developed, viz. (1) high pressure or "shock" moulding, and (2) machining.

When making moulded refractors the sheet is heated uniformly to 140-160 deg. C. to bring it into a flexible state, when it can be deformed at comparatively low pressures by a number of techniques. Low pressure shaping, however, cannot be used for the shaping of prismatic components of high accuracy as the definition obtained is inadequate, and it has been necessary to go to high pressure moulding using compression presses. Satisfactory moulds have been made from both zinc-base alloys and from mild steel, but it is usually preferable to use heat-treated steel. The wear of the moulds is negligible and no deterioration in the quality of the mouldings should take place over runs of many tens of thousands of components.

Advantage has been taken of the good machining properties of acrylic sheet to develop machined plates as this method reduces tooling costs. Milling machines with ganged rotary cutters running at as high a speed as possible are used in this process. The best finish is obtained by taking an initial heavy cut followed by a fine finishing cut. Refractor plates are generally machined from ⅜-in. sheet with about ⅛-in. of material left at the root of the prisms.

A large amount of information is given in the paper with regard to the performance of methacrylate refractors, and figures are also given with regard to the mechanical properties, it being pointed out that some of

them, including the tensile strength, vary not only with the temperature but also with the straining rate.

Illustrations are given in the paper of the application of methacrylate to various types of lanterns, and consideration is then given to service performance. It is emphasised that information regarding the service performance of materials used in street lighting equipment should be available to engineers and designers as laboratory experiments have only a limited value. The behaviour of methacrylate under conditions of outdoor exposure is less complex than that of many other materials, such as metals. It is, for example, unattacked after total immersion for 14 days in 30 per cent. hydrochloric acid, 20 per cent. sulphuric acid, concentrated sodium hydroxide, and concentrated sodium carbonate. The results of service tests over periods of four to five years justify the conclusion that the methacrylate components of street lighting equipment will be immune to chemical attack by atmospheric gases and vapours over a service life of ten to 15 years at operating temperatures up to 70 deg. C.

Two other factors can, however, cause degradation of performance, viz. (1) discoloration caused by light and ultra-violet radiation, and (2) surface deterioration due to abrasion. Discoloration due to exposure out of doors, however, is very slight, as shown by the results of a series of field tests.

Standard scratch tests made on methacrylate have given results comparable with those for aluminium, but the results are so variable that the authors hold the view that the best guide to performance as regards abrasion is given by field tests. Such tests as have been carried out indicate that deterioration due to abrasion will be small.

Finally, the authors discuss service tests. It is pointed out that comprehensive service tests are difficult to organise but should it be possible to arrange trials by co-operation among lighting authorities, the information so obtained would be most valuable. In the meantime two pieces of specific information are available in addition to general reports of satisfactory performance and indicate the behaviour which may be expected. The first relates to observations made over a long period on the performance of an installation of 80-watt fluorescent lamp reflector lanterns in which the lamps and anodised aluminium reflectors are enclosed by single curvature methacrylate bends. Both reflectors and cover were cleaned by wiping with a soft wet cloth to minimise scratching and there are no evident signs of abrasion of the cover due to cleaning or wind-borne dust, and no trouble has arisen from collections of dust caused by electrostatic charges which can be generated on methacrylate sheet by dry polishing. The fall in illumination at street level due to dirt accumulation over this period is less than 20 per cent. and it has been found that a cleaning period of six months in all but the most heavily polluted atmospheres is adequate.

The second case relates to a large number of open type 60-watt sodium lamp lanterns in Salisbury on which tests were carried out to determine the service behaviour of methacrylate refractor panels. Plates were mounted in two lanterns, one of which was adjacent to the railway, in November, 1947, and they were removed for inspection in July, 1950. During this period they were serviced in the same manner as the glass plates in the other lanterns, the cleaning period being three months. The plates were photometered after removal and cleaning, and their performances compared with the performance of control plates. All gave values of peak and average candle power lying well within the limits laid down and there was no significant difference between the mean values for the exposed and control plates.

The authors, assessing the general trends of future development, suggest that it is probable that the major use of unmodified methacrylate will continue to be in sodium vapour and fluorescent lamps. There seem to be considerable possibilities for developing lanterns which will reduce maintenance. Sealed refractor plates, one-piece construction and contours which are to some extent self-cleaning, all help to this end. It has been suggested by some engineers that when fluorescent lamp life reaches 5,000 hours, a design for a completely sealed lantern which would only need breaking down for relamping once a year, would offer marked advantages in view of the rising cost of servicing. There are also possibilities of considerably reducing the cost of reflector lanterns. Further, little use has so far been made of curved refractor plates, and developments here may be expected.

Dr. S. English (Holophane, Ltd.), criticised the figures in the paper for the relative impact strengths of "Perspex" and glass of the same thickness, and claimed that modern toughened glass had a very much greater strength than "Perspex." With regard to thermal strength, he referred to tests on bulkhead fittings in which it was shown that the inside temperature was much greater than the outside temperature and deformation of the "Perspex" took place.

Mr. I. M. Heald (Triplex Safety Glass Co.) said a form of mounting "Perspex" lanterns to metal frameworks, using a rubber gasket, had been devised.

Mr. F. H. Pulvermacher (South Wales Electricity Board) asked for information with regard to other plastics than "Perspex," and expressed disappointment that nothing was said in the paper about the use of plastics with metal filament lamps.

Mr. Walker, replying to the discussion,

(Continued on page 388)

Exhibition of Street Lighting Apparatus

The exhibition of modern street lighting lanterns, columns, etc., at Bournemouth created considerable interest. In the following account it is only possible to deal with some of the latest equipment.

During the course of the A.P.L.E. conference an indoor exhibition of street lighting equipment was held at the town hall. Complete units, columns and lanterns, were erected in Braidley-road, close to the town hall.

Electric Lanterns

Of special interest on the stand of *The Brighton Lighting and Electrical Engineering Company, Ltd.*, was a new "Upright" type fluorescent lantern for Group "B" Lighting. The lantern, illustrated on this page, is conical in shape and houses either two or four 2-ft. 40-watt lamps. It is circular in section and is glazed with three sections of curved "Perspex" sheet. With the two-lamp model the back section is glazed with diffused opal "Perspex," while the two sections fronting the roadway are fitted with clear "Perspex" windows. For each of the two 40-watt fluorescent lamps an anodised aluminium wing reflector is fitted. This is designed to give a two-way directional light distribution. With the four-lamp model, the three windows are glazed with opal "Perspex" to give a general light distribution.

Also shown was a new model of the cylindrical fluorescent lantern No. 700, to take 5-ft. lamps arranged for pole top mounting. There was also a selection of Bleeco street lanterns for use with tungsten, sodium, and mercury lamps for Group "A" and "B" lighting. A new development of this company was the production of a complete series of flood projectors for both long range and close-up floodlighting for all types of lamps. This series has been developed especially for the Festival of Britain.

The British Thomson-Houston Company, Ltd., showed a selection of street-lighting equipment, including lanterns for use with tungsten, sodium vapour, mercury vapour, and fluorescent lamps. The display included the fluorescent street-lighting lantern for use with two 2-ft. 40-watt lamps for Group "B" roads.

Amongst the many types of lamps for street lighting shown was the new electric discharge mercury vapour lamp, which is designed to operate horizontally without the use of magnetic arc control. Four new Mazda floodlights were displayed, together with the Mazda "Three," a unit capable of a wide range of applications.

The "Corona" lantern (illustrated) was one of the many displayed by *Crompton Parkinson, Ltd.* This lantern, for Group "B" roads, is available in

The Bleeco "Upright" fluorescent lantern.

"Mazda" fluorescent street lighting lantern for Group "B" roads.

two sizes for 45/60-watt and 85/140-watt sodium discharge lamps, and is designed primarily for side entry, although it has facilities for top entry. It consists of a silicon aluminium alloy top casting surmounting a hinged "Perspex" bowl, with hermetically sealed "Perspex" refractor plates. There is an internal anodised aluminium reflector which ensures the maximum utilisation of light. The lantern is dustproof and gives a high optical performance.

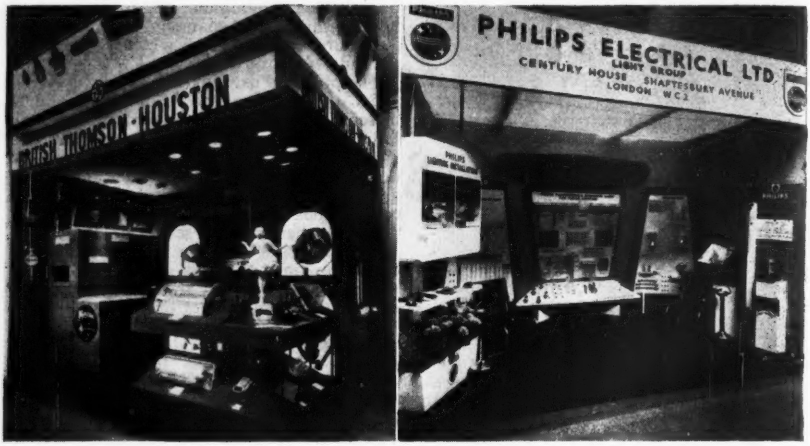
Also displayed on this stand was the "Orion," for use with 250/400-watt horizontal burning mercury discharge lamps. The canopy is cast from silicon aluminium alloy, and includes a special split cone locking device for side entry mounting, for which the lantern is primarily designed. The optical system comprises an internal anodised aluminium reflector and an outer heat-resisting prismatic glass bowl. Other lamps were the "Leo" for 250/400-watt vertical burning mercury discharge lamps, the "Lion" for 300/500-watt lamps, the "Sirius" for 100/200-watt tungsten filament lamps, the "Taurus" for 80/125-watt mercury discharge lamps, and the "Stella" I and III for mercury discharge and mercury fluorescent lamps respectively.

The Edison Swan Electric Company, Ltd., exhibited prototypes of a completely new range of street lighting equipment. These lanterns are for use with sodium, mercury discharge, and tungsten lamps. The SSB-1 is designed for side entry and houses a 45/60-watt sodium discharge lamp. The canopy to the lantern is made from corrosion-resisting aluminium alloy castings and finished in grey enamel. The refractor plates are of "Perspex," which is sealed to the outer enclosure.

The principal exhibits of *Falk, Stadelmann and Co., Ltd.*, were the "Fulmar" I and II lanterns for use with horizontally burning sodium discharge lamps, for Group "A" and "B" roads respectively. The canopy of both these lanterns is in cast aluminium alloy, and supports a "Perspex" U-shaped cover panel, to which "Perspex" refractor plates are hermetically sealed on the inside. This "frameless" design has the advantage of eliminating shadows on the roadway thrown by the ordinary framed fittings. Also displayed were examples of Group "A" and "B" lanterns for high-pressure mercury discharge and tungsten filament lamps.

Several new lanterns for a variety of applications were among the exhibition the *General Electric Company's* stand. New fluorescent designs comprised a four-lamp vertical lantern, and two two-lamp versions of the existing Three-Eighty lantern, one for 5 ft. and the other for 2-ft. 40-watt lamps. An addition to the company's

B.T.H. Company's "Three" floodlight projector.



A wide range of fluorescent, mercury, sodium and tungsten lamps was shown on the stands of the British Thomson-Houston Co. Ltd., and Philips Electrical, Ltd.

range of sodium lanterns was an open wing reflector for one 140-watt lamp.

The four-lamp vertical fluorescent lantern (Z.8482) is particularly suitable for main thoroughfares, city squares, etc. It is a post-top mounting type with the four lamps and aluminium reflectors inside a fluted "Perspex" enclosure, with aluminium top spinning and cast base.

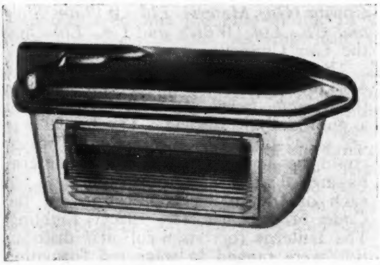
The G.E.C. four lamp vertical fluorescent lantern.

Both the new variants of the Three-Eighty lantern (Z.8281 for two 5-ft. lamps, and Z.8242 for two 2-ft. 40-watt lamps) employ the principle of light control by means of "Perspex" refractor plates cemented to the inside of the "Perspex" dish by a process that makes an almost invisible joint. The arrangement of the lamps and reflectors causes the lantern to appear uniformly flashed all over from all angles of view up to 80 deg. from the downward vertical.

The new sodium lantern (Z.9410) consists of a cast iron body with a glass reflector above the single 140-watt lamp, and is arranged for top entry. The Z.9450 totally enclosed sodium lantern for main roads, to take one 85-watt or 140-watt lamp, was also shown.

As usual, *Holophane, Ltd.*, showed a range of their refractor glassware as well as various street lighting units. Illustrated is their newly developed cylindrical sodium refractor lantern for use with 85-watt and 140-watt lamps. A special feature of this lantern is that the refractor assembly can be rotated about the horizontal axis to adjust main beams in relation to any road gradient. Thus road brightness is maintained and glare is reduced.

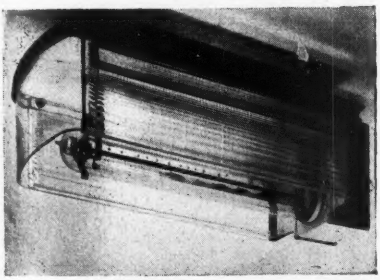
Various lanterns manufactured by the *Metropolitan-Vickers Electrical Co., Ltd.*, were shown on columns as part of the outdoor exhibition. They included the top-entry version of the "S.O." Fifty lantern.



The Crompton "Corona I" lantern

This lantern has maintained all the elegance and efficiency of the side entry model by redesigning the canopy. A central boss is fitted to the canopy to take 1½-in. B.S.P. thread bracket. The boss is made of silicon aluminium alloy and also forms the lampholder and lamp support. Provision is made to prevent moisture entering through the boss.

The "S.S. 51," illustrated, is another entirely new lantern which has been developed for Group "B" roads. It consists of a die-cast L33 silicon aluminium alloy canopy and a clear enclosing bowl supported by a stainless steel hinged ring.



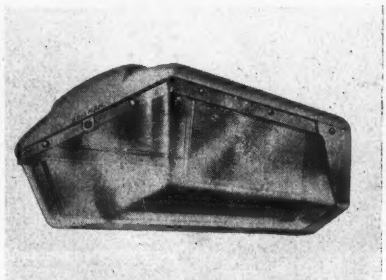
The Falk Stadelmann "Fulmar" lantern

The bowl is available in glass or "Perspex." The refractor, which can be supplied for symmetrical, axial, or non-axial distribution, is held and located with respect to the road direction in a support assembly which includes the lampholder. A separate earthing terminal is provided in the lantern canopy.

Philips Electrical, Ltd., presented a selection of tungsten, fluorescent, blended, mercury, and sodium lamps together with several different types of fluorescent lighting fittings.

Amongst the range of street lighting equipment shown by the *Revo Electric Co., Ltd.*, was the A.O. 28212/1, a new decorative lantern for two or four 2-ft. 20-watt or 2-ft. 40-watt fluorescent lamps mounted nearly vertical. The lantern is specially designed to eliminate shadow around the base of the supporting column. There was also a comprehensive range of other street lighting equipment.

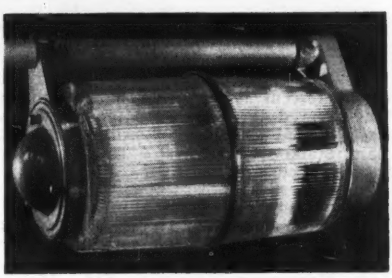
A newly designed Wilton-Sieray lantern for Group "A" roads was on view on the *Siemens Electric Lamps and Supplies, Ltd.*, stand. This unit has provision for three 5-ft. lamps, although it is available in a modified form to take either two or four lamps. The bowl pivots from the head of the lantern and is made of "Perspex." An interesting feature of this lantern is that some three-



The Ediswan SSB-I Sodium discharge lantern

quarters of the weight, including control gear, is carried in the head of the lantern which is recessed into the concrete pole. The weight is thus supported by the pole and not by the cantilever. Examples of the small Wilton-Sieray 2 x 40 lantern for Group "B," as well as ranges of typical floodlighting equipment and lamps, were also shown.

With the forthcoming "Festival of Britain" in mind, *Thorn Electrical Industries, Ltd.*, devoted part of their stand to the colour floodlighting of public buildings



Holophane Sodium refractor lantern

Views of the Holophane and Siemens' stands where many different types of lanterns for street lighting were displayed.

by fluorescent lamps. For street lighting they showed the PLQ/3080 lantern which was arranged so as to demonstrate its quick starting and stability over a wide range of voltage fluctuation.

Gas Lanterns

Exhibitors in the gas section included the *British, Foreign and Colonial Light Controlling Co., Ltd., William Edgar and Son, Ltd., Horstmann Gear Co., Ltd., Metropolitan Gas Meters, Ltd., Parkinson and Cowan (Gas Meters), Ltd., William Sugg and Co., Ltd., Willey and Co., Ltd.,* and the *Gas Council.*

The *Gas Council's* exhibit included a working model of a main road, showing the various types of street lighting, and a photographic display. The model was of a 42-ft. main thoroughfare which could be lighted in turn by lanterns having distributions corresponding to each of the main classifications in the Code of Practice for Street Lighting. The lanterns for "non-cut-off" distribution were ranged in staggered formation with appropriate overhang, spacing at 120 ft. "Cut-off" lanterns were mounted centrally over the thoroughfare with a spacing of 90 ft. In each case the lamps were mounted at a height of 25 ft. The effects of changes in the road surface on the type of lighting were also shown in the model.

As well as their usual range of "Maxilla" lanterns for Group "B" roads, *Parkinson and Cowan (Gas Meters), Ltd.,* introduced the new "Maxilla Festival" lantern, which will be available next year. The lantern incorporates several new devices. The refractor plates are made with Holophane prism glass which have been specially designed for maximum light distribution.

Columns, Control Gear, etc.

The Stanton Ironworks Company, Ltd., showed eight columns in the outdoor demonstration, each of which was fitted with lanterns supplied by different manufacturers. Four of these columns have a mounting height of 25 ft. and are available in narrow base and standard base styles. The remainder were for side street lighting.

Also displayed was the base of one of the spun concrete columns showing how the steel reinforcement is arranged.

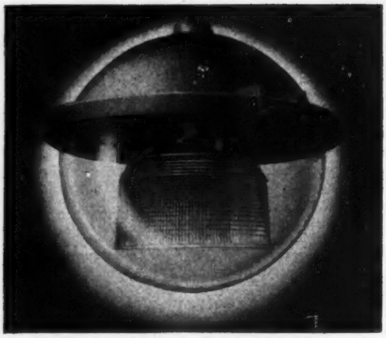
The "Adastra" range of galvanised sectional steel poles exhibited by *Poles, Ltd.*, cover all general usages on street lighting. The columns are designed in tapering hexagonal and circular sections, and lanterns can be mounted at any required height. Adequate provision is made in the base of the columns for auxiliary equipment including slotted steel instrument panel and inspection door. The columns are extremely strong and light in weight. A complete column, irrespective of overall length and dimensions, occupies no more cubic space than that of the base or largest section, into whieh the other sections nest one inside the other. This facilitates transportation and erection.

Stewarts and Lloyds, Ltd., exhibited a selection of their tubular steel lighting columns for gas and electric lanterns. The four main types on view were the Bracket Arm Type and the Shepherd's Crook Type, suitable for main traffic routes, with a mounting height of 25 ft., and the Swan-Neck Type and Pillar Type suitable for roads other than main traffic routes, with mounting heights of 15 and 13 ft. respectively.

In this section *Revo Electrical Company* were showing a range of their artificial stone, steel, and cast iron columns and brackets. Among their new developments were an illuminated Bollard constructed in heavy gauge steel and cast iron and the "Festival," a cast iron column finished in gilt paint and looking most impressive carrying a C. 13428 (4- and 5-ft. 80-watt vertical fluorescent tubes) lantern.

Concrete Utilities, Ltd., showed a number of their lamp columns. This com-

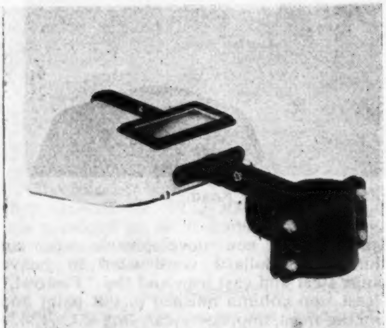
A view of the outdoor display in Braidley. Road.



Metrovick "S.S.51" Lantern.

pany has for some time aimed at reducing the size of the column at ground level in order to avoid obstruction on the footpath as far as possible. Bracket arms giving an overhang of from 1 ft. 6 in. to 8 ft. were shown. Columns with different types of finish were also displayed. The *Springbank Quarry Co., Ltd.*, also exhibited concrete lighting columns.

Manufacturers of street lighting control gear included *Sangamo Weston, Ltd.*, who showed a full range of their time switches, designed for a wide range of automatic time control applications on controlled frequency A.C. circuits; *Venner Time Switches, Ltd.*, who showed a small synchronous motor-driven, solar dial double circuit switch suitable for fluorescent lighting; *Metropolitan Gas Meters*, the *Horstmann Gear Co., Ltd.*; and the *Automatic Telephone and Electric Co., Ltd.*



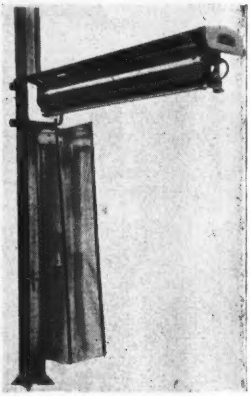
The Gowshall "Signlite" fitting.

Amongst the display of bollards, illuminated guard posts, and traffic signs by *Gowshall, Ltd.*, was the "Signlite," a completely new fitting for the external illumination of all signs up to the very largest "Advance" signs.

The *British Developments Association's* stand displayed a number of illustrations of street lighting equipment. Their new brochure on fluorescent street lighting was available for the first time.

The *Triplex Safety Glass Co., Ltd.*, showed a number of fittings fabricated from "Perspex" and carried out a number of

The new Siemens fluorescent lantern showing bowl lowered.



demonstrations illustrating the strength of this plastic material.

Tower ladders were shown by the *Ford Motor Co., Ltd., Shaftesbury Ladders, Ltd.*, and *Vauxhall Motors, Ltd.*

A.P.L.E. Conference

(Continued from page 381)

said that tests had been carried out which showed that "Perspex" has a higher impact strength than toughened glass, indeed, as much as four times greater. The authors did not consider it wise to use "Perspex" for metal filament lamps because of the temperature. Finally, he said there were other plastics but some of them were very unstable to light.

The usual "Open Forum" was held on the last day of the Conference, when a number of points were raised.

New Problems In The Lighting of Tunnels

Though vehicular tunnels are perhaps not as common in this country as in some others, the problems of lighting them are nevertheless of considerable practical interest. This article describes some of the work now being carried out in the U.S.A. on this subject.

By S. G. HIBBEN*

The proper illumination of a modern vehicular tunnel is, like the construction and the maintenance thereof, scarcely a job for the amateur. In fact, the task of tunnel lighting includes much more than the provisions for discernment of objects in a long, narrow passage way—more than just the overhead lighting of a public thoroughfare where the eye remains for considerable periods of time under the same conditions of surrounding brightness, and more than just the normal provisions for quick and easy accessibility in the case of lamp renewals and cleaning. Good design of equipment can contribute more to minimum investment and lower operating costs than is usual in the lighting of a conventional structure. Power must be conserved because burning hours are many—usually 8,760 annually. Glare and discomfort from flickering effects are hard to avoid.

The problem has been made still more complicated in recent years since many vehicular and pedestrian tunnels have increased in length and especially in density of traffic. These conditions have naturally involved increasing difficulties of ventilation, proper policing and safety precautions plus the constant desire to improve the comfort and rapidity with which the seeing task is performed.

Up to about the period when the Scheldt River Tunnel at Antwerp or the Holland Tunnel under the Hudson River in New York City were respectively lighted with sodium vapour lamps and 200-watt incandescent filament lamps (*circa* 1925), the usual practice was to place industrial types of metal reflectors along a centre ceiling line or worse still, to hang pendant some conventional street lighting housing, ill-fitted by reason of bulk and intrinsic brightness to this position. Obviously any such units that would be permissible when arranged on both sides of a carriage way along an outdoor street and mounted well above the normal line of vision would not produce anything like the glare troubles that, in some instances, were experienced in a tunnel where the mounting height perforce was barely sufficient to clear the tops of the vehicles—an elevation generally on the order of some 12 ft. In fact, previous to that era, and in the cases of bare incandescent bulbs that illuminated such famous tunnels as Rotherhithe and Blackwall, London; the Elbe in Hamburg, or the Glasgow Tunnel and others familiar to the reader, the striking defect was glare.

A forward step in tunnel lighting was very definitely taken when, as in the case of the Holland Tunnel (later followed in the case of the Lincoln Tunnel in New York and several others of similar design), the incandescent units were of the 150 or 200-watt size enclosed in metal boxes and recessed along both sides, immediately below the junction of the flattened ceiling surface and the side walls. In the simplest form, these boxes were glazed with a light density milk glass which to the motorist presented a brightness

* Director of Applied Lighting, Lamp Division, Westinghouse Electric Corporation.

Fig. 1. A view of the twelve-foot fluorescent units lighting the Brooklyn-Battery tunnel to twelve foot lamberts on the side walls.

ranging from about 15 foot-lamberts to an almost zero brightness, largely depending upon the viewing angle. The output efficiency of the typical unit was roughly 40 per cent. Fortunately for the achievement of uniformity, these tunnels were lined with white tile, and the majority of the light flux was directed against the opposite wall. Thus the rather well illuminated (70 per cent. reflectance) side walls, especially on curves, would provide a reasonably comfortable bright background against which darker objects could easily be seen. In the case of almost any vehicular tunnel, the brightness of the roadway is very low, generally on the order of 0.1 to 0.5 foot-lamberts, and because of its low reflectance (10 per cent.) it would seem rather futile to direct any major amount of flux solely towards the roadway surface. Thus one of the newer problems is to provide silhouette seeing of vehicles, and not to be much concerned with the road surface.

The disadvantages of the conventional incandescent lighting system with flush-mounted wall boxes include the wide variation in brightness, possibly ratios in the order of 100 to 1. Operating costs may be high because of the comparatively low efficiency of the incandescent lamp coupled with the necessity of bulb renewals at periods of about 1,000 hours. Specifically this means complete relamping on the average of eight times annually. The advantages of the usage of incandescent sources include simplicity, a minimum of controlling and operating accessories, and complete independence of ambient temperature variations. Due to the plurality of wall emplacements with attendant fitting of the tile, and complicated by the conduit runs behind the tiling, this method may not insure the lowest installation cost. For reasonably good visibility such a system ought to have at least 10-watts per running foot of tunnel length—twice this amount near the portals during hours of daylight.

In order to provide better uniformity, less variation in brightness, more accessible fittings and a ready means of control of foot-candle intensities, one of the most recent installations (the Brooklyn-Battery Tunnel, New York) has employed a novel installation of fluorescent lighting coupled with unique control. Here, in two lines, along both edges of the hung ceiling, are placed six-foot T-8 slimline instant-start fluorescent lamps electrically and mechanically mounted in pairs, each pair end to end and enclosed in a 12-foot hard glass (clear) tube of 2.5 in.

external diameter. Each such glass housing is a complete unit, inserted against spring connections in bronze holders spaced approximately 12.5 ft. apart. Each line of light is essentially continuous for the total 9,117 ft. of the tunnel's length. Actually, in the Brooklyn-Battery Tunnel the installation consists of twin tubes, hence a total of some 5,790 fluorescent lamps are installed. The brightness ratios roughly are from 6 foot-lamberts to 0.5 foot-lamberts—somewhat greater at lower than 80 deg. F ambient and higher at currents above 50 ma.

It is indeed the controllable variation of current through the fluorescent lamps that is the outstanding feature of the installation. Throughout each end of each tunnel for a distance of some 1,800 feet the installation consists of slimline hot cathode lamps. On bright days the lamp current is of the order of 450 milliamperes throughout the first 150 ft., some 350 ma. throughout the next 300 ft. and so on, stepping gradually down to a minimum of 75 to 100 ma. when one has progressed the 1,800 ft. from the entrance-way. From there on and throughout the centre section of the tunnel, the same dimensions of lamps are used except that these are not normally dimmed or brightened by current adjustments and consist of conventional cold cathode tubes operated at 50 ma., but mechanically interchangeable with the hot cathode slimline lamps.

On bright days the entrance and exit lighting is stepped up to the fullest intensity. During the dark night-time the reverse takes place, namely, the dimming of the artificial lighting near the portals. Outside of the portals high intensity mercury vapour lamps of the 400-watt size provide approximately 1 foot-candle of horizontal illumination on the roadway. Generally the transition from low to high brightness during the normal 12-minute passage by motor-car throughout the full length of the tunnel is found to be quite agreeable. Other features of this rather novel installation include the control of the lamp current by saturable core reactors, the grouping of six units together in sections on different wiring circuits, the de-energising of the sockets when the 12-foot tube and its two fluorescent lamps are removed for lamp replacement, the fact that the entire equipment can be subjected to water spray washing without corrosion troubles, the long life of the units (of the order of 4,000 to 7,000 hours), and the use of the warm, white tint of

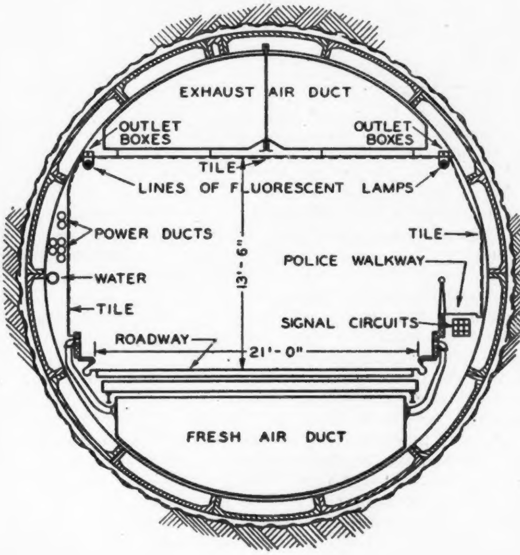


Fig. 2. Section of the Brooklyn-Battery Tunnel showing position of the continuous lines of fluorescent lamps that illuminate the traffic portion.

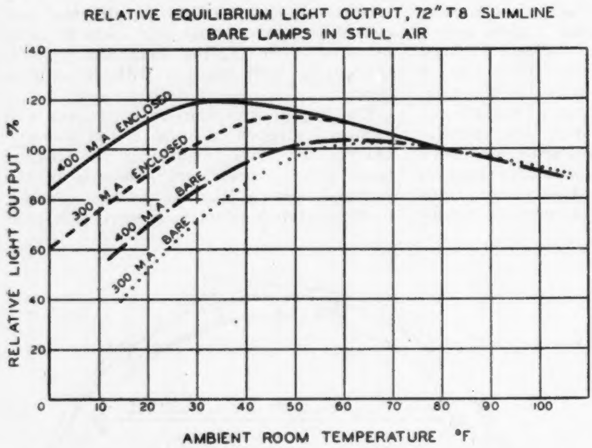


Fig. 3. Showing the effect of enclosing slimline fluorescent lamps in glass tubes, and also the efficiencies at low temperatures.

fluorescent lamp, minimising the contrasts of colour under conditions of varying current.

The protection of the enclosing glass tubing around the fluorescent lamps is not only mechanical but this also improves the general efficiency of the combination, especially when the ambient temperature is below about 70 deg. F. The slimline fluorescent lamp burned in open air has its maximum efficiency at about 65 deg. F. When the ambient temperature falls to about 20 deg. F., the efficiency of this lamp falls to about 40 to 60 per cent. of maximum respectively for 300 ma. and 400 ma. currents. At the same 20 deg. air temperature, but when enclosed in the glass tubing, the relative efficiency of the 300 ma. operation would be about 90 per cent. of normal maximum, and in the case of the 400-ma. operation the actual efficiency would be some 40 per cent. higher than obtainable with the lamp exposed. In many tunnels where the ambient temperature may easily fall below 50 deg. F., the heat conservation characteristic of the enclosing glassware is thus important.

Normally the slimline fluorescent lamp is not designed to do its best at low currents, say of the order of 50 to 100 ma. The American-made slimline lamp of this 6-ft. T-8 size generally operates on a ballast transformer having an open circuit voltage on the order of 600. However, when, as in this particular installation, there are times when the lamps are to be burned at less than 100 ma. and when they must surely start at impressed voltages in the neighbourhood of 900 the experimental alternative has been to increase the gas pressure within the fluorsecent tube in the interests of overcoming the tendency towards shortened life at low currents. More experience will have to be gained regarding harmonics of the current supply, of influence of gas pressure on life and efficiency, as well as the matters of optimum graded brightness. Nevertheless, the main features of this described system seem to form an excellent pattern for future installations involving high-speed vehicular traffic and when aiming at a comfortable visual environment.

The Trotter-Paterson Memorial Lecture

It is announced by the Illuminating Engineering Society that the first Trotter-Paterson Memorial Lecture will be held on January 17 next, at 6 p.m., at the Royal Institution, Albemarle-street. The honour of giving this first lecture has fallen to Dr. J. W. T. Walsh, who will lecture on "The Early Years of Illuminating Engineering in Great Britain."

The lecture is not restricted to members of the I.E.S., but is open to the public. In view of the wide field of activities and associations of both A. P. Trotter and Sir Clifford Paterson, there will no doubt be many who will wish to attend the lecture. Admission will therefore be by ticket only (to both I.E.S. members and others). Tickets may be obtained from the I.E.S. Secretary, 32, Victoria-street, London, S.W.1.

Street Lighting in Singapore

By C. C. PAYNE*
M.I.E.E., Mem.A.I.E.E.

In 1946, following the occupation period, the whole of the street lighting in Singapore had to be replanned and reorganised. The following article gives an account of the progress which has been made to date

Singapore, situated at the foot of the Malayan Peninsula, is an island with an area of some 217 square miles. A large number of nations are represented in its thickly populated community, which now totals 1,000,000 people, of which 700,000 are in the municipal area of 31 square miles.

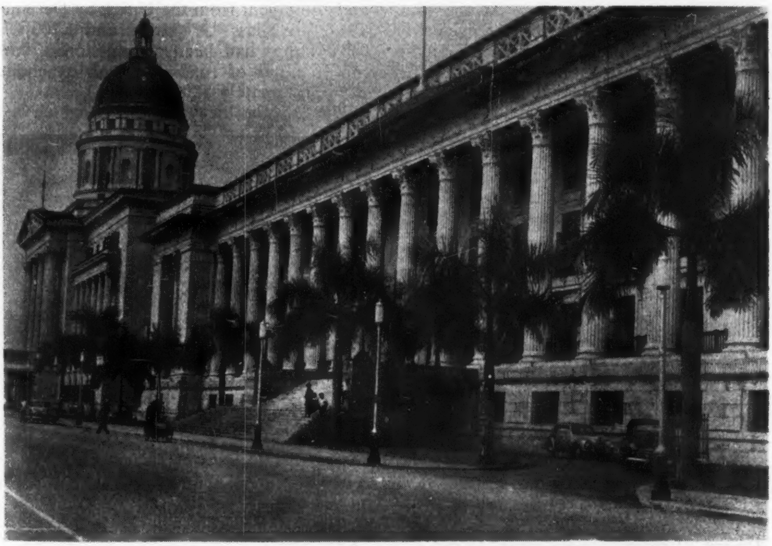
Before the Japanese occupation of Singapore, the "Trimmer Report" Committee published its recommendations for the improvement of street lighting conditions in Singapore and had in most cases adopted the findings of the Ministry of Transport Departmental Committee's "Final Report," published in 1937.

Unfortunately, with the intervention of the Japanese War it was not possible to adopt these recommendations, and work on the improvement on street lighting was delayed until the return of civil administration in 1946, when a "Five-year Programme of Street Lighting" for the gradual change-over from gas to electricity was approved by the Municipal Commissioners.

In order to carry out these schemes a Public Lighting Engineer, Mr. K. G. James, was appointed in December, 1946, under the Municipal Electrical Engineer, to form a completely new section of approximately 200 men, comprising labourers, jointers, wiremen, fitters, masons, etc., who were to be trained in this new work.

It was found that during the period of

* Municipal Electrical Engineer, Singapore.



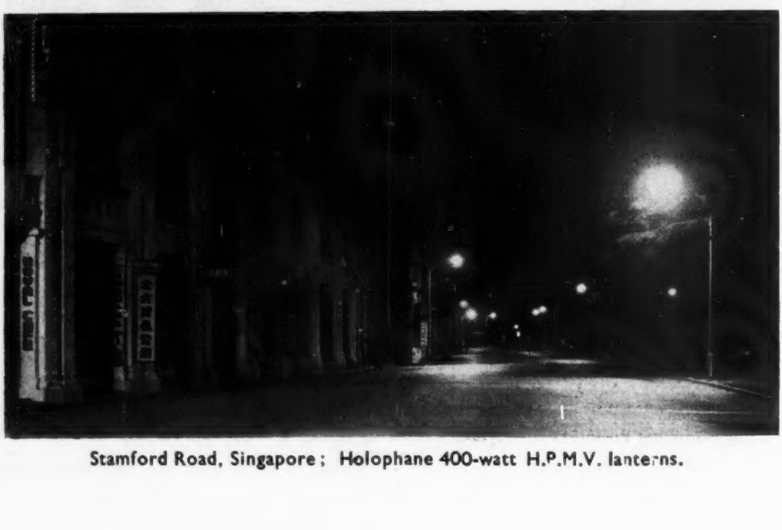
The Municipal Buildings at Singapore showing G.E.C. 4 × 20-watt vertical fluorescent lanterns.

Scotts Road, Singapore; G.E.C. 125-watt H.P.M V. "Oxford" lanterns.

the occupation the pre-war 4,000 gas street-lamps and 1,400 electric street-lamps fell into disuse and practically all the fittings and poles were either removed by the Japanese or looted in other ways. At the time of the Japanese surrender, only ten electric street-lamps were found in use (outside the main police stations) and little more remained of the original gas lamps.

The "Five-year Programme" scheduled for the installation of over 60 miles of roadway, and although the work was delayed in the early stages of the scheme during 1947 (due to the delay in deliveries of materials and equipment from the U.K.), by December, 1949, 800 Class "A" lamps and 1,200 Class "B" lamps had been commissioned, covering 50 miles of roadway at an expenditure of approximately $800,000 (S.S.).

Due to the heavy rainfall, which aver-



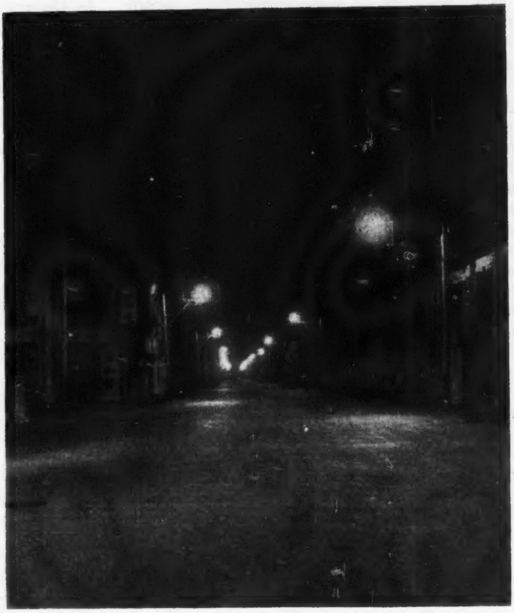
Stamford Road, Singapore; Holophane 400-watt H.P.M.V. lanterns.

ages 95 in. per annum, careful consideration was given to the type of street lighting fittings and gear to ensure that they would stand up to these unusual climatic conditions. Mainly for reasons of economy, the majority of lanterns are of the "non-cut-off" type, and it has been found that, although these have been subjected to both torrential rains and a humidity factor of approximately 85 per cent., no trouble has yet been experienced through ingress of moisture—which speaks well for this type of British lantern, which is a standard model also produced for the home market.

The main roads of Singapore are mainly of asphalt surface carriage-ways, with widths varying from 40 to 60 ft.; in the case of minor roads the surface consists of a waterbound granite carriage-way, with widths varying from 18 to 30 ft.

Mounting height of Class "A" and Class "B" lamps have been set at 25 ft. and 15 ft. respectively, with an overhang in the case of the wider Class "A" roadways of 6 ft., and in the case of Class "B" 2 ft. 6 in. Spacing of poles on Class "A" routes varies between 120 ft. and 150 ft. to suit local conditions, and on Class "B" routes is at an average of 110 ft.

On those main roads where the maximum road width is over 60 ft. poles have been sited on opposite sides of the road; where central islands exist poles are sited at the centre of the road to light the dual carriage-ways. Along main traffic routes trolley-bus poles have been utilised for mounting, the spacing of the poles varying from 110 ft. to 120 ft. In



(Top right) Selegie Road ; B.T.H. 3×80-watt fluorescent lanterns centrally suspended from traction poles.

(Bottom right) Serangom Road ; 400-watt H.P.M.V. Holophane lanterns mounted on traction poles.

Orchard-road dual carriageway lighting; 250-watt H.P.M.V., G.E.C. "Dioptrion" lanterns.

places where the aesthetic qualities of the installation are of some importance, locally manufactured pre-cast reinforced concrete street-lighting columns have been installed along both Class "A" and "B" roads.

Maintenance of the lamps installed up to date has been carried out with a small staff of wiremen with the use of one recently purchased motorised tower waggon. No great difficulties have yet been experienced on this work apart from the fact that during the early stages of the scheme an unusually large number of premature failures was experienced with solid-filled type chokes, and it would appear from subsequent investigations that the faults developed due to the heavy condensation of moisture taking place in the early hours of the morning.

The control of the 2,000 street-lamps is effected by the use of time-switches, either on individual or group control, but it is intended to install a system of E.H.T. injection control during 1950-1951.

Further schemes of street lighting have now been approved for 1950 whereby a further 30 miles of road lighting are scheduled for completion by the end of this year. A second "Five-year Programme" of street lighting is in course of preparation, which schedules for an additional 100 miles of roadways, comprising approximately 4,000 Class "A" and "B" lamps. It is envisaged that by the end of the current year all main traffic routes of Singapore will be illuminated by H.P.M.V. street lighting, and this second programme will therefore cover, in the main, those subsidiary roads which the Municipal Commissioners consider are next in priority for improved lighting.

Trade Notes

Messrs. Fredk. Thomas and Co., Ltd., designers and manufacturers of lighting fittings, have recently opened a showroom at Everton Buildings, Stanhope-street, London, N.W.1, where they have on show a comprehensive range of modern and period lighting fittings.

The Practical Electrician's Pocket Book for 1951 has just been issued by Electrical and Radio Trading, 6, Catherine-street, W.C.2. Price 5s. (post free), it contains a lot of useful information in a small space, including a section on lighting.

British Electric Lamps, Ltd., have opened new showrooms at 229-231, Westminster Bridge-road, S.E.1. Resulting changes in sales organisation include the move of Mr. A. Francis Brown, sales manager, to head office at Wimbledon and the appointment of Mr. L. J. Tijou as showroom manager.

A Code of Practice for Street Lighting

A draft on the lighting of traffic routes has recently been issued for comment and is reviewed in this article.

Since the withdrawal of B.S.307 : 1931 at the end of 1948, the only official guide to current street lighting practice has been the report of the departmental committee set up by the Ministry of Transport in 1934. This report was published in 1937, when it made the suggestion that the British Standards Institution should issue a formal specification to implement its recommendations. The preparation of this specification was well advanced when the war and the blackout made further work impossible, but the studies were recommenced in 1944 and a draft specification for the lighting of traffic routes was issued in 1945. Discussion showed that this specification was not acceptable and in 1947 it was abandoned in favour of a Code of Practice which would be a statement of current good practice and of the fundamental requirements of street lighting as described in the 1937 report, rather than a definition of the exact design and performance of the installation. This has now been done, taking the conclusions of the 1934-37 report as the basis and making such modifications as have appeared necessary in the light of subsequent developments.

The draft of the new Code of Practice has recently been issued by the B.S.I. for comment and, although it will doubtless be modified in detail before the final version is published, it may be welcomed as a very useful addition to the reference books on street lighting. It deals only with traffic routes (Group A roads); the B.S.I. committee is already studying the problems of "other roads" and a further code of practice dealing with them will doubtless be issued later. It gives the aims rather than the rules of street lighting and sets out the factors which need to be taken into account in reaching the series of compromises which are the basis of all good installations. The definition of traffic routes is taken direct from the 1937 report—the main approach roads to centres of population or through built-up areas which carry appreciable pedestrian traffic—and the principal characteristics of the lighting are substantially the same, namely, 24 ft. to 30 ft. mounting height and 2,500 lumens to 7,000 lumens per 100 linear feet of roadway, the light output being evaluated in the lower hemisphere only. There is no reference to the actual illumination of the road surface in lumens per square foot which formed so prominent a part of B.S. 307 : 1931 but which bears little relation to the surface brightness of the carriageway.

The draft code is based on silhouette vision of objects in the roadway and provides for the carriageway, footway and the backgrounds being made sufficiently bright and uniform for obstructions to be readily seen in strong contrast. This requires that there should be no dark parts of the background against which such obstructions might become inconspicuous or which would mislead road users in judging distance, speed or direction; this, in turn, requires that the arrangements and location of the lamps should be very carefully chosen in relation to the course of the roadway and to the distribution of intensity from the lanterns. Three types of intensity distribution are considered—cut-off, medium-angle and high-angle—and the draft code describes the several types of arrangement in considerable detail.

Cut-off lanterns are those which emit most of their light at angles below 75 deg. from the downward vertical and relatively little above 80 deg. They are used where it is particularly desirable to reduce glare to a minimum and, because the light area produced by each lantern as seen from the road is in the form of a broad ellipse, they must be placed fairly close together and at reasonably uniform spacing if the light areas are to overlap on the carriageway. The suggested spacing is 90 to 100 ft. and not more than

110 ft., and the suggested arrangement is in opposite pairs at the kerbs or along a central line over the carriageway. Cut-off lanterns have special advantages for lighting roundabouts which are approached by unlighted roads, where the outer kerb of the roundabout must be lit, but glare to drivers approaching the roundabout must be avoided; for steep gradients where drivers proceeding uphill might be subject to considerable glare and for roadways near aerodromes where no upward light is permitted.

Non-cut-off lanterns are those which emit their principal beams of light at angles usually between 70 degrees and 80 degrees and which give an appreciable amount of light above 85 degress. In the draft code, two types are recognised although there is no clear differentiation between them: the medium-angle type from which the highest intensities are towards the lower angles and the high-angle type from which the highest intensities are nearer to the horizontal. The light patch from such lanterns is T-shaped, the cross-bar being comparable with the broad ellipse given by a cut-off lantern and the tail extending along the road surface towards the observer. The medium-angle distribution gives a relatively short tail and gives less glare than the high-angle distribution but the spacing of the latter may be longer and is less critical. Medium-angle lanterns may be mounted either centrally or at the sides of the road but high-angle lanterns should only be mounted at the sides; the usual arrangement is staggered with spacings of 120 ft. to 150 ft. and single-side mounting is not recommended except on bends where the lanterns should be located on the outside of the curve according to principles which are described in detail in the draft code.

The greater part of the draft is concerned with the arrangement of the lanterns, the distances between the rows and the overhang, the treatment of road junctions and intersections, bends, roundabouts, and dual carriageways, and each of these sections is fully illustrated by line diagrams which cater for the majority of the situations likely to be found on traffic routes. This detailed guidance has not previously been published in this form and it will prove of great value to those concerned with the planning of installations. The approach to the various problems is very practical and yet scope is left for the individual skill and experience of the planner. There is one set of diagrams of particular interest—a road junction which is lit in two ways, both giving a reasonably uniform surface brightness but one of the arrangements of lanterns might give very misleading impressions of the course of the road to drivers approaching the junction and this is illustrated in perspective sketches as well as in a plan. Emphasis is placed on the value of making perspective drawings of awkward pieces of road throughout the whole draft and this to be commended. Another pair of diagrams shows how easily an installation can become over-complicated if the rules are followed too literally and how economies may be effected by judicious pruning and re-arrangement, preferably using a large-scale plan after careful examination of the site.

The section on glare is necessarily inconclusive because the requirements of high road-surface brightness and freedom from glare are contradictory. A new definition of "Directional Intensity Ratio" is given and this may add to the value of this function as a very rough indication of the likelihood of glare, but no single figure can be taken as a figure of merit in this respect. The treatment of sharp gradients, bridges and roundabouts is largely left to the skill of the engineer in dealing with each particular set of circumstances. For long gradients, particularly, there seems no satisfactory solution other than a lantern which may be rotated about a horizontal axis so that the beams are both at the same angle of elevation from the road.

Although the draft code gives detailed attention to the positions of the lanterns and the distribution of light, there is very little about the surface of the road, except an expression of hope that the highway engineer and the lighting engineer should consult together. A light, fairly smooth surface is required and the technique of high road-surface brightness on which this draft is based is very difficult to apply to either a very rough dark surface or to a highly polished surface. Warning is given against the irregular texture often resulting from patching of the road surface but more information on this very important factor in street lighting would be welcomed by both the lighting engineer and the highway engineer.

Some useful general comments are given on maintenance which is regarded as including all the factors which affect performance and which are under the control of the lighting engineer. The "test point" defined in B.S.307: 1931 has been dropped because it has not been found possible to lay down a single method of test which would be a criterion for the comparison of different types of installation, but it is suggested that a simple illumination test should be agreed between the parties concerned and should

be made when the installation is first put into service and then at suitable intervals. A reasonable level of maintenance should give figures not less than 60 per cent. of the initial test results, provided that the test has been so chosen that it reveals any major changes in distribution of light as well as the reduction in light output due to age and dirt.

The draft code concludes with two appendices, one of a technical nature dealing with the exact siting of non-cut-off lanterns on bends in the road and the second indicating the items of information which should be supplied with a specification or with a tender. This second appendix is quite different in character from the other material in the draft and comes close to the originally attempted standard specification, but it does not seem out of place and it demonstrates that the drafting committee were continually aware of the need for making a practical approach to the whole problem.

In our June issue the French recommendations for street lighting were reviewed, and it is of interest to compare the two documents. The French code starts with two excellent chapters on the nature of vision in artificially lit streets and on the subject of road surfaces which state the problems more clearly than in the British draft, probably because the present draft is based on the 1937 M.O.T. Report in which the problem of lighting traffic routes was reduced to the production of high surface brightness. Both documents contain rather inconclusive sections on the distribution of light and both discuss the location of the lanterns in detail, although there is little in the French code on the treatment of junctions and bends. In France, single-side mounting is usual in narrow streets where we prefer the staggered arrangement, but these would not generally be regarded as traffic routes and can scarcely be compared with the British practice in this draft. The illumination is expressed in average lamp lumens per square metre (lux, *pace* " Dimwit ") of road surface whereas the British custom is to express it in terms of the lower hemispherical flux from the lanterns per 100 linear feet along the road. The French code goes into considerable detail on the subjects of light sources, fluorescent lighting, lamp posts of cast iron, steel and concrete, bracket arms, ancillary equipment, cabling, methods of supply and control, and corrosion, none of which are covered by the British draft. The French code is also more comprehensive in its discussion of maintenance and makes some recommendations regarding the methods to be adopted. The British draft is much more precise in its guidance on the siting of lanterns, and also it discusses the properties of cut-off lanterns and high-angle distributions, central suspension and the treatment of gradients, which are scarcely mentioned in the French code.

The principal criticism of the draft Code of Practice must be that it does not go much further in fundamentals than the 1937 M.O.T. Report, and one might wish that the highly expert knowledge of the drafting committee had been permitted to cover a wider field and had been encouraged to be more precise, even if somewhat arbitrary, in its recommendations. The effects of increased mounting height, the problems associated with fluorescent lighting, the effects of the brightness of the sides of the road and of the upper hemisphere in relation to glare and acuity—these are subjects which might well have found a place in a statement of good practice, and we should have welcomed some more definite comments on the distinction between high-angle and medium-angle, on the merits of a broad spread of light in plan, on the control of glare on gradients and perhaps on the effect of the colour of the light source on the speed of vision. When the committee comes to the preparation of the draft on " other roads " (Group B), we may hope that it will be enabled to cover its subject more widely than in the 1937 M.O.T. Report. But B.S.I. committees ought to be unanimous and, as it might prove impossible to obtain more definite statements on such indefinite subjects, we must be content with the excellent material given in the present draft.

Light and Lighting

Increase in Subscription

During recent years the cost of production of printed matter has steadily increased. In the case of this journal some improvements have been made in the layout, presentation, and contents which have also increased the cost of production. We feel, in fact we know from the comments we have received, that these changes have been welcomed. It is with regret, however, that we have to announce that from the January, 1951, issue the price per copy of the journal will be increased to **one shilling and sixpence,** and the annual subscription will be increased to **one pound.**

The Manufacture of Spun Concrete Lighting Columns

By F. CORNELIUS

As far as the writer is aware, the manufacture of lighting columns in concrete is comparatively recent, and certainly none were manufactured prior to the Great War, 1914-1918; but immediately after that war, due to the shortage of metals, the concrete lighting column began to make an appearance.

At that time, any columns would have been manufactured by the only known method of making concrete material, employing the ordinary vibratory method of consolidation. Shortly afterwards, about 1922, the centrifugally spun method reached this country from Australia and was taken up primarily for the manufacture of concrete pipes, when it was discovered that, due to the centrifugal force employed, the resulting concrete was considerably stronger than any which had been previously manufactured. After years of experience with centrifugally spun concrete, a vast amount of knowledge on this subject had been accumulated, but it was not until the year 1937 that centrifugally spun concrete lighting columns were manufactured in this country.

Experience with this method of manufacture soon disclosed the fact that the advantages hitherto obtained by the use of centrifugally spun concrete were maintained and, indeed, improved upon in the manufacture of lighting columns. The centrifugal force imparted to the concrete not only provides the necessary bore in the centre for subsequent services to the lantern but the walls of the columns were found to be so dense that the weight of the concrete was as great as 165 lb. per cubic ft.

Before dealing with the method of manufacture, I would like to touch on the question of suitable aggregates, the selection of which is a very important factor. Precise control must be maintained from the moment the basic ingredients are chosen until the finished article leaves the manufacturer's yard. The three raw materials used are, generally, approved granite, sand, and British Portland cement, which must not only meet defined requirements, but must pass all tests laid down by the British Standards Institution before being accepted as suitable for their purpose. The cement made by reputable manufacturers in this country is generally beyond reproach, but laboratory tests should be made to ensure that each consignment received is suitable. The sand and granite should also be tested with equal care, in order to determine that they are of the correct quality, and that the grading to specified sizes is suitable for the production of the densest possible concrete. The mixing of the aggregates and cement is also of importance and should be carried out in a modern, efficient, mechanical mixer for a definite length of time. If the concrete has to be transported from the mixer to the spinning machine, it is necessary to make quite sure that no segregation of the particles has taken place en route, and if there is any chance of this a re-mixing hopper should be used.

Up to recent years the method of manufacture was to upright the mould in which the column was to be spun, and fill it with concrete. During the filling process the concrete was vibrated to consolidate it and fill the mould, but it was found that spinning compressed the concrete to such an extent that the bore in the centre was of too great a diameter with the result that the column had to be again filled and vibrated prior to the final spinning.

It was found experimentally that the modern concrete pump, which is capable of pumping concrete to a height of 200 ft., or horizontally 1,000 ft., could, if pumping into a closed mould, exert sufficient pressure to force enough concrete into the mould so that after one spinning operation the correct

size of bore was produced in the centre of the column. The modern procedure therefore, is to use a concrete pump, provide a small hole in the mould to release the air during the pumping operation and to pump into the mould sufficient concrete so that it is completely filled under pressure before the filling operation is stopped.

Immediately after this operation the spinning takes place at a pre-determined speed which sets up very great centrifugal pressure on the mass of concrete which in turn forces the water to the inside of the column and packs the concrete solidly against the wall of the mould. By this method a perfect section is obtained (see illustration No. 1) in which all the materials are evenly consolidated, no segregation has taken place, and the section is completely voidless.

Considerable thought is being given to pre-stressed columns employing the superior concrete obtained by the centrifugal spun process, but most manufacturers agree that they have not quite reached the stage when it is commercially possible to drop the normal reinforcement and substitute pre-stressed reinforcement.

I am purposely, therefore, not discussing pre-stressed reinforcement, although a good deal is known on this subject, but will confine my remarks in this respect to the method generally used at present. Reinforcement is probably more essential in a lighting column, due to its extremely small section, than in any other structure built of concrete—and, obviously, the reinforcement must be fabricated precisely and carefully to ensure that it renders to the column all the strength necessary to withstand reasonably rough handling, to say nothing of the stresses due to the overhanging brackets, wind pressures, etc., after it has been installed in position. The

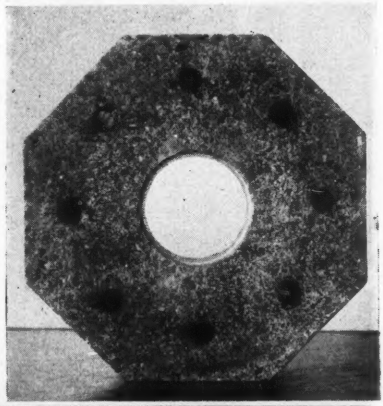


Fig. 1 *(Top Right)*. Section through a spun concrete column. Fig. 2 *(Above)*. Showing the apparatus used for pumping concrete into moulds.

reinforcement is, therefore, usually fabricated from high tensile steel rods by a spot welding process which ensures rigidity of construction and ample strength.

As with the other raw materials the steel used must pass the tests laid down in the appropriate British Standard, and once again it is advisable that routine tests should be carried out to ensure that the steel conforms to the British Standard before it is used in the fabrication of the reinforcement.

Thus by ensuring that the aggregates, cement, and steel, comply with their appropriate British Standards, and given precise control of proportioning and mixing of the concrete, and strict control and supervision during the various stages of manufacture, there is no reason why the lighting columns so produced should not meet the requirements laid down in the British Standard 1308:1946, and in particular the clauses relating to tests. Routine testing of the manufactured columns will ensure that a standard of high quality is maintained.

The reinforcement is actually positioned in

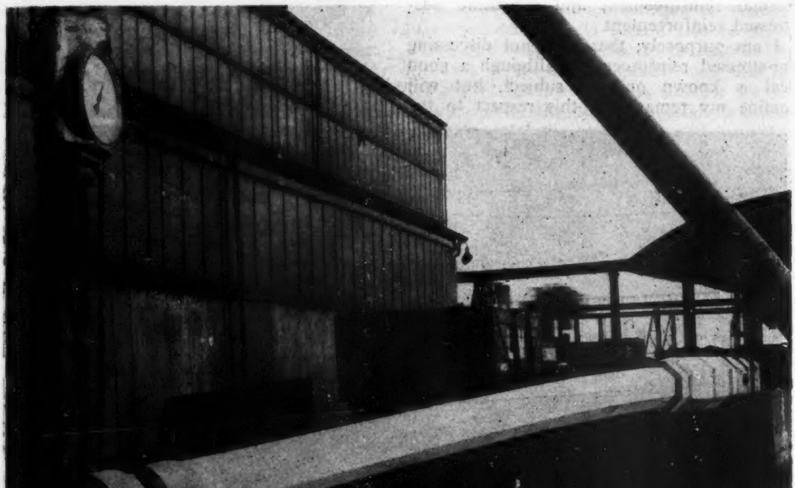


Fig. 3 *(Top Left)*. The base of a column after having been struck by a lorry. Fig. 4 *(Above)*. Showing the considerable deflection obtained in a column during a beam test.

the mould by means of concrete bobbins, so placed as to secure correct cover over the reinforcement, the mould having been previously cleaned and greased. During the centrifugal spinning and consequent vibration, serious stresses are set up in the mould which render it necessary that the moulds are of rigid steel construction and are strong enough to withstand the high pressures exerted inside the mould during the filling and the centrifugal action. The moulds have also to impart sharp, clean features to the columns. They consist of two sections bolted together and form a complete unit. After being placed into position on the spinning machine, the mould is ready to receive concrete from the pump referred to earlier (see illustration No. 2). This pump can discharge one ton of concrete in little more than three minutes, and the pressure exerted by the pump in the filling of the mould, combined with the correct centrifugal force applied during spinning, ensures even distribution of the aggregate, elimination of voids, and maximum density of the concrete.

Concrete so produced obviously possesses very high tensile and, more important, high compressive strength, the centrifugal action to which it has been subjected leaving a convenient bore through the middle of the column.

The moulds for use during centrifugal spinnning are so expensive that it is necessary to extract the column without undue delay, and it is obvious that the operation must be planned in such a way that it is known exactly when the column is sufficiently matured before its extraction. It is, therefore, impossible to rely on the atmospheric conditions at the earlier stages of maturity, and for this reason it is advisable to adopt an artificial method of procuring a humid atmosphere. This is usually created by steam or hot-water. After several hours of this treatment, the moulds are dismantled and the columns removed.

The finished surface of the column is important from an aesthetic point of view, and centrifugally spun concrete lends itself to treatments for the improvement of the surface. Some makers adopt a method whereby the surface of the column is ground to a fine granolithic finish, similar to smooth natural stone, which finish is permanent and weatherproof, and no other treatment is either necessary or desirable. After the columns have been duly inspected, the switch-box in the base is fitted with a door, a back board is provided for switchgear, etc., and, after a final inspection, the column is usually taken into an open-air stockyard, where it is left for a period of at least six weeks before despatch.

Centrifugally spun columns have very great shock-proof qualities which are amply demonstrated by traffic incidents in many parts of the country. On one occasion, a lorry loaded with ten tons of material ran away down a hill, crashed into a concrete column and, after bouncing off the column,

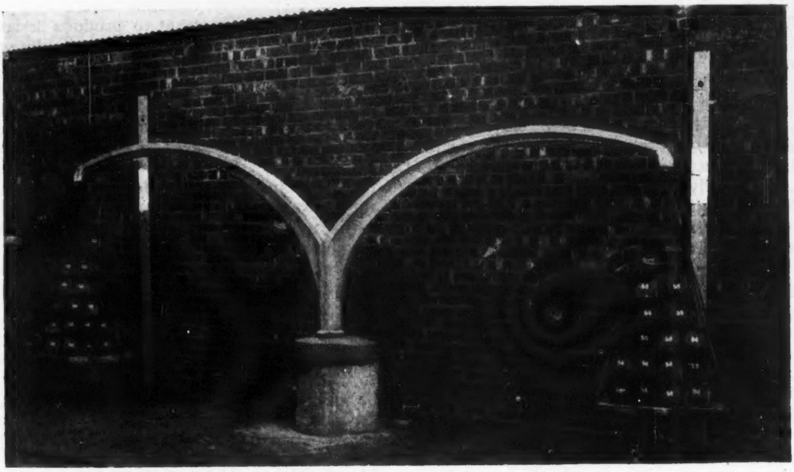


Fig. 5. Showing a bracket carrying a weight of 840 lbs. at each end.

demolished the front of a garage. The column was afterwards touched up and is still standing in the same position (see illustration No. 3), although the lorry is on the scrap-heap.

Due to the extreme density of centrifugally spun concrete, corrosive industrial atmospheres do not affect it. It is rust-proof, of course, and electrically non-conductive, and it is not necessary, or even desirable, to wash the columns with any sort of paint, cement, or other wash.

This article has dealt only with columns which are not pre-stressed, due to the fact that, in my opinion, pre-stressed columns have not been given sufficient experience in practice to be quite certain of their behaviour; but very good results have been forthcoming using the ordinary known method of reinforcing, suitable longitudinals of high tensile steel (which should, if possible be in one continuous length, and not joined or lapped), together with suitably designed stirrups at frequent intervals. During tests it is frequently found that centrifugally spun columns, using such reinforcements, have produced results equal to six or seven times the requirments of the appropriate British Standard Specification.

It is also possible to obtain a very great deflection in columns during test, without circumferential cracks appearing, and, as will be seen by illustration No. 4, showing a beam test in which the base of a 22 ft. 6 in. column is firmly anchored, the spigot has been deflected to 10½ in. under a load of 1,254 lb. without any permanent set.

It is very doubtful if pre-stressed concrete will ever be employed for the reinforcement of concrete overhanging brackets carrying a lantern at the top of the column, and certainly they can never be made by the centrifugal spun process; but it is worthy of note that the present type of reinforcement will carry considerably greater loads than required by the British Standard.

Illustration No. 5 shows a bracket measuring 16 ft. from end to end, carrying a weight of 840 lb. at each end, whereas the appropriate British Standard Specification for this type of bracket requires approximately a load of 100 lb., according to the type of lantern used.

All concrete columns, whether centrifugally spun or otherwise, are generally subjected to their greatest bending moments during handling, stacking and erection, and therefore great care must be exercised during loading, despatch, unloading and erection. Experience has solved the problems which arise during the handling of these columns, and they now reach their destination without mishap. The erection also requires care, and attention must be drawn to the necessity for using the correct lifting points as recommended by the manufacturers. It is safe to say that if the manufacturers' suggestions are adopted, the work of handling and erection will proceed smoothly and efficiently, and the columns will be erected without the slightest damage. Once erected, the centrifugally spun concrete column will look after itself and will render a great public service without detracting from the beauty of the countryside, and without any maintenance costs whatsoever.

As spun concrete columns have a long life in service it is important to produce designs which are not likely to "date" quickly and considerable attention is being paid by manufacturers to this aspect. Before a new design for a main-road lighting column (25 ft. mounting height) is put into production, consultation takes place between the Ministry of Transport and the manufacturers, and finally the design is passed by the Royal Fine Art Commission, which exists to safeguard the standard of public amenities.

Acknowledgement is made to Messrs. The Stanton Ironworks, Co., Ltd., for permission to reproduce the illustrations.

Colour Group

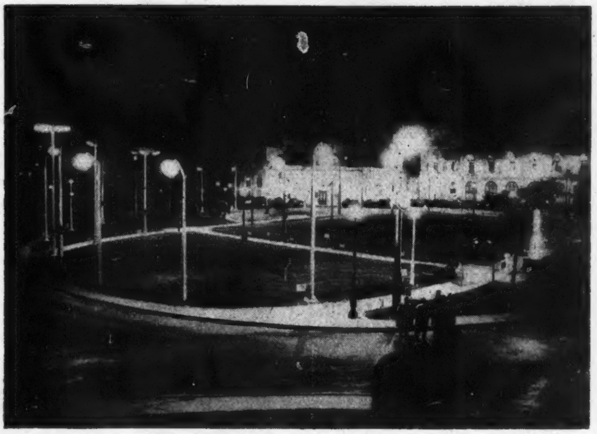
At the meeting of the Colour Group to be held at 5.30 p.m. on November 9 at the Institute of Ophthalmology, Judd-street, W.C.1, a paper entitled "A Theory of Luminance Discrimination" will be read by Mr. R. W. G. Hunt of Kodak, Ltd. The December meeting of the Group will be held at 3.30 p.m. on December 6 at the Lighting Service Bureau when a paper on "Variations in Normal Colour Vision in Relation to Practical Colour Matching" will be given by Mr. F. L. Warburton, of the Wool Industries Research Association.

Personal

Following the examinations for the Final Grade Section "B" certificate in illuminating engineering in 1949, the silver medal award for that section has been awarded by the City and Guilds of London Institute to Mr. P. D. Figgis, Registered Lighting Engineer (I.E.S.). Mr. Figgis is with the lighting department of the British Thomson-Houston Co., Ltd.

Thorn Electrical Industries, Ltd., announce that Mr. C. B. Styles, Registered Lighting Engineer (I.E.S.), has been appointed senior lighting engineer at their Manchester office.

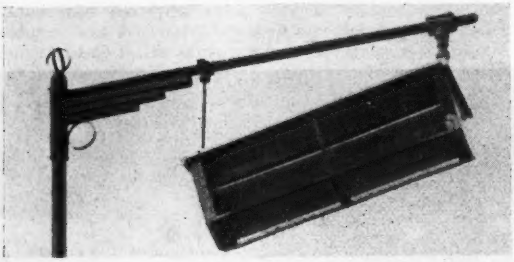
Exhibition of French Street Lighting Apparatus



The first exhibition of public lighting equipment and apparatus to be arranged in France was held during an annual conference of local government officials at Cabourg in June. The main part of the exhibition was held in the gardens of the Casino, where 50 different types of lamp columns were erected showing 35 kinds of bracket arms and over 100 lanterns and traffic signs. There was also a display of lanterns and equipment inside the Casino, where a number of demonstrations was staged. A night view of the outdoor exhibition is shown in the illustration at the top of this page.

The illustration alongside shows some of the latest types of concrete columns and lanterns. The French manufacturers are now producing both concrete and steel columns and brackets of very good quality.

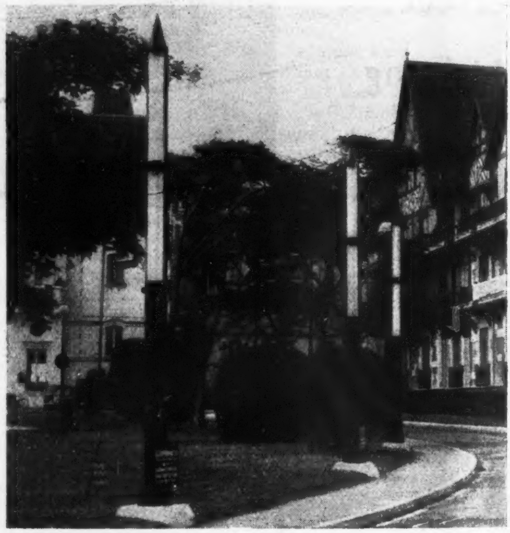
The exhibition included a wide variety of lanterns for use with incandescent lamps. The range covered rather costly apparatus for lighting in towns to the simplest apparatus for lighting in rural areas. The lanterns were made either of



copper or steel with reflectors almost invariably of anodised aluminium.

Considerable attention has been given to means of facilitating maintenance and the replacement of lamps; as one prominent French street lighting engineer puts it the difficult and dangerous position in which maintenance staff are placed has been ignored for too long. The latest lanterns are all designed to give easy access for lamp replacement and adjustment of reflectors and cleaning whilst doing all that is possible to ensure the safety of the workman who has to carry out these operations at the top of a tower ladder some 25 ft. above the road.

A feature of the exhibition was the progress which has been made in the adoption of fluorescent lamps for public lighting. It would appear that French activities in this direction, at one time far behind Great Britain and certain other countries, are now producing good results. Improvements which have been made on earlier lanterns include reduction of weight, improved starter gear (though it is understood that there are indications that in the near future starters will be replaced by instant start



gear), and, perhaps the most important of all in some respects, the reduction of the cost of lanterns. One handicap which has yet to be overcome is that of a suitable and economical lantern enclosure, the price of "Perspex" being still very high in France. One fluorescent lantern is shown at the top of this page.

Other new developments included a vertical unit housing two, three or four 4-ft. fluorescent lamps which it is thought will be very suitable for lighting in residential avenues. A day and a night view of these units is illustrated on this page.

The Switching of Street Lighting By Centralised Ripple Control

This method of the switching of street lights is relatively new, and its advantages, as well as the difficulties encountered, are not always appreciated. The following article briefly explains the operation and describes an installation.

By J. F. MACKENZIE

Introduction

Increasing interest is being shown in the application of centralised ripple control to the switching of street lights, and the number of installations is steadily increasing. The claims of enhanced operational facilities, the almost non-existent maintenance demand and the economic advantages over existing methods, warrant investigation on a wider scale than hitherto. Although firmly established, the art is relatively new.

General

The control utilises the electrical supply network as the medium for signalling. This is a very sound choice for both economic and practical reasons. As the network is existing there are no extra costs for the signalling medium, and as the signal automatically accompanies the service to the lamp, great convenience and ease of application is ensured thereby.

The signal current is distinct in frequency from the supply current, and is filtered out in a relay fitted in lieu of a manual switch or time-switch at each lamp position or group lighting position. The signal current is injected into the network at a central point. Control can be made either directly from this central point or from any other position via two pilot wires to this control point.

Injection

The injection or "superimposition" of the signal current upon the existing electrical network is common to all systems of ripple control. The frequency applied is of the order of 400 to 1,500 cycles, i.e., within the voice-frequency range. A motor-alternator is used to generate the signal current; this is energised from the 400-volt supply, and is of relatively small size. The output is about 30 kw., the motor being about 40 h.p. The actual size is decided by the extent and loading of the network to be controlled.

Certain systems demand a multiplicity of signal frequencies, i.e., one frequency for each signal. The motor-alternator to provide these then requires accurate speed control, involving a direct-current source and special control gear. The use of a single-signal frequency to provide multiple signals enjoys the advantage of permitting the application of a motor-alternator of standard design.

The most satisfactory and invariably the most economic method of injection into the network is by means of parallel connections into the high-tension bus-bars. The actual connections are made via special capacitors similar to those used for power-factor correction. They are of about 3 mfd. capacity. These coupling capacitors offer a high impedance to the 50-cycle voltage, preventing feed-back currents of any magnitude. They offer a reduced impedance to the higher frequency signal currents, and this impedance is reduced further to a negligible value by means of "resonance." This involves the use of inductors so tuned that resonance occurs at the operating frequency, the effect of which is to enable the signal currents to pass with high efficiency while reducing the 50-cycle current circulation to a very low value.

Fig. 1 shows the electrical connections in schematic form for parallel injection of ripple currents into the network; Fig. 2 shows how these currents "ripple" the normal wave-form of the 50-cycle supply

currents; and Fig. 3 shows the injection current components — motor - alternator, inductors and capacitors.

In order to remove the possibility of danger to an operator under fault conditions —particularly on open-circuit fault, a line-isolation transformer is introduced between the motor-alternator and the inductors. This is earthed at the centre or " star " point on the H.T. connected side and this is separated in the windings from the low-tension side by insulation capable of withstanding safely the high-tension voltages. This transformer also appears on Fig. 3.

The Relay

Having transmitted a signal over the supply network, a means of filtering this from the supply and operating a suitable switch is now required. This is provided by a relay which also is capable of discriminating between distinctive " On " and " Off " signals.

Usually up to twelve signals are provided and found adequate for any one installation and up to four of these signals are applied to street lighting control. The usual allocation is " Dusk On," " Midnight Off," " Dawn Off " with the fourth signal used for " Prior Dawn On."

Each relay carries two signal facilities, " On " and " Off," so that where discrimination is required between, say, " Midnight Off " and " Dawn Off," differently adjusted relays are used at the relevant points. One will respond to the " Midnight off " signal and ignore the " Dawn off " signal, the other will respond to the " Dawn off " signal and ignore the " Midnight off " signal, while both respond to the " Dusk on " signal.

The signal is first filtered from the supply by a simple electrical filter consisting of an inductor and a capacitor. This filter is common to all methods of ripple control although the design varies in that one accepts all the signal frequencies while another accepts only one preselected signal frequency.

It is in the means used to discriminate between one signal and another that the principal difference occurs between commercial systems. This difference is not confined in its influence to the relay alone, but affects the whole installation with respect to the size, cost and method of injection. The

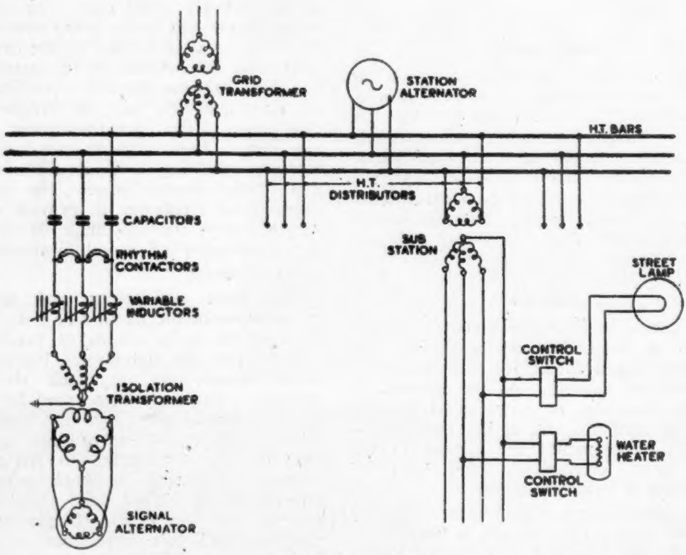


Fig. 1. Ripple control high tension parallel injection.

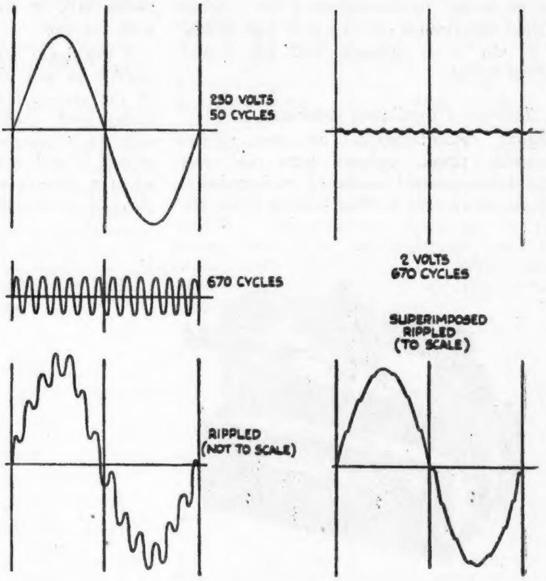


Fig. 2. Rythmatic ripple control.

operating principle of the relay may indeed be said to control the success of the system operationally and economically.

To discriminate between signals, some form of mechanical resonator is always used. Three principal methods are in use. These methods are:—

(a) A slow-speed oscillating armature, embodied in a galvanometer or solenoid type of relay.

(b) A reed.

(c) A mechanical selective device operating on a time-impulse method.

The last method has not been applied in this country.

A brief description of these methods will

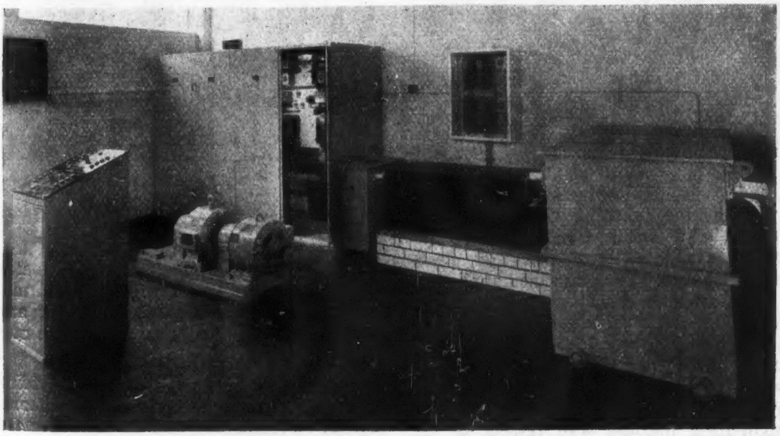


Fig. 3. Showing the injection current components.

first be given, to be followed by a more detailed description of (a) which has proved to be the most suitable and has found greatest favour.

(a) *Slow-speed oscillating armature.*

Signal discrimination, on the single-frequency ripple current used for this method, is obtained by means of impulsing. The signal current is first filtered from the network by the electrical filter. It is then rectified in a small metal rectifier and becomes available as a series of direct current impulses. These are then applied to a galvanometer relay and influence the pivoted armature. This armature is under the control of a spiral spring and has a natural, fixed period of oscillation or "swing." A continuous D.C. current would only cause it to move a few degrees towards a right-angle position with respect to the galvo coil and when de-energised it would swing back to its natural plane, in parallel with the coil.

If the signal current is impulsed at a speed exactly in step with the natural oscillation of the armature (say, one second) this will swing with gradually increasing amplitude with each impulse until after, say, five impulses, it will reach an optimum amplitude when a contact attached to the spindle will close momentarily against a fixed contact, thereby energising a locking relay which switches the main circuit.

If, however, the impulses do not match exactly the natural oscillation of the armature, it cannot attain an amplitude of any extent, being continually damped by the out-of-step-impulses.

It will thus be seen that by providing relays with armatures adjusted to different periods of oscillation, and by impulsing the signal at corresponding rates of impulses,

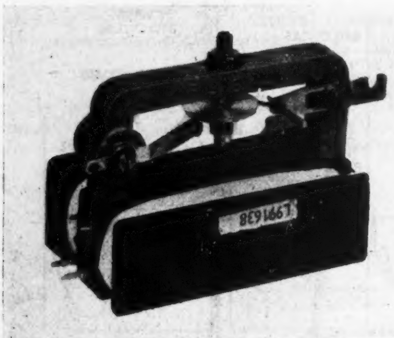


Fig. 4 *(Left.)* The self-interrupting galvanometer.

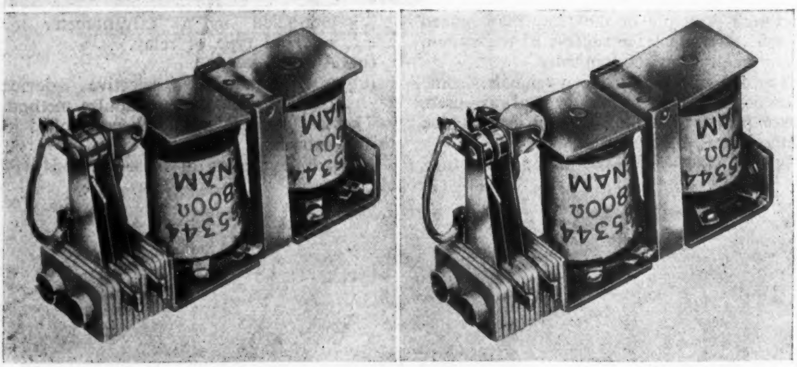


Fig. 5 *(Below.)* Showing the switching relay with *(Left.)* the contacts closed and *(Right.)* the contacts open.

discrimination can be made between one relay and another.

In practice 12 different impulse rates can be operated, providing 12 distinctive signals with one carrier frequency.

This method enjoys immunity from false operation through spurious "signals" and is made sensitive to ¼ volt while responding correctly to wide signal voltage variations. Although a "coded" relay, i.e., one requiring the dual selection of frequency and rhythm, the mechanism is extremely simple, as can be seen from Figs. 4 and 5, showing the two moving parts contained in the galvanometer relay and the switching relay.

(b) *Reeds.*

Signal discrimination is obtained by applying a different voice-frequency current for each signal. The electrical filter accepts the total band of frequencies used and discrimination is made in the mechanical resonator which consists of reeds. The reed is adjusted to vibrate at a specific frequency corresponding to the voice frequency transmitted. Up to 12 different signals have been provided by this method.

Two methods are used to convert the reed vibration into switch operation. One method shown schematically in Fig. 6. applies a pawl to the reed, which then causes a ratchet wheel to rotate and, via suitable gearing, tip a mercury switch. One reed drives the wheel forward to close the switch, the other reverses the direction to open the switch. While simple in concept, elaborations in switch design are involved to ensure reliable response. These include over-riding cams to lift pawls at end of travel, centrifugal clutch to avoid false operation from spurious signals and gear train to obtain necessary power, all of which result in a low sensitivity value of eight volts. This low sensitivity demands large injection currents, and this, coupled with the necessity for careful limitation of signal voltages, demands "series" injection of the signal current. This restricts operation of the power distribution arrangements and involves costly injection plant. While relay response is satisfactory, its adoption in this country has been very restricted.

The alternative method of operating the switch from the reed is by means of contacts actuated directly by the reed. This is shown schematically by Fig. 7. The power is so small and the need to avoid damping the reed so great that unorthodox contacting means have been adopted. A "bouncing" contact is pivoted near the root of the reed and is normally resting on another contact fixed to the reed. When the reed vibrates, the bouncing contact is caused to open intermittently. This inserts a thermostatic switch in circuit, which, after a period, responds to operate the main contacts.

The slow-acting thermostatic switch is used to avoid false operation from the "surge" potentials ever present in the supply circuits. By virtue of the reduced mechanical loading this relay can be made more sensitive and operational values of ¼ volt are again possible. Unfortunately, voice-frequency reeds are vulnerable to

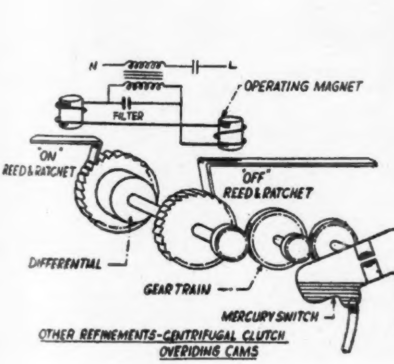


Fig. 6. Reed relay direct drive.

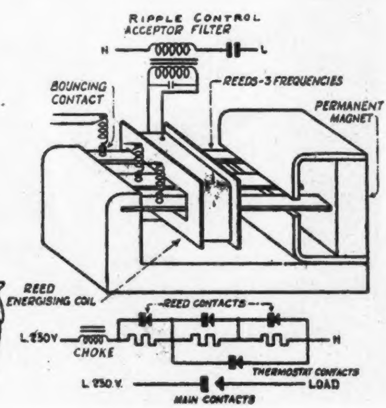


Fig. 7. Reed relay contact type.

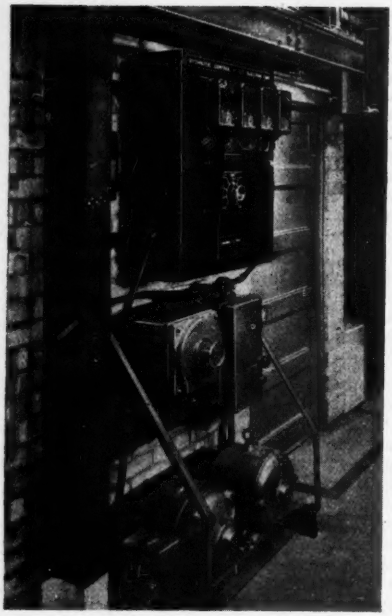


Fig. 8. The small reinjection plant for automatic reinjection of the signal.

harmonic currents and to the frequencies set up by arcing contacts such as slow-break thermostats which are used domestically in ever-increasing numbers.

Time Impulse Relays

The principle applied involves a "starting" impulse followed by an "operate" impulse. The "start" impulse sets in motion a synchronous electric motor of the "clock" type which is incorporated in the relay. This motor rotates a code wheel via gearing, etc.

This wheel is so shaped that at a particular point in its travel a pin can be inserted which, when carried forward, will operate the main contacts. The travel of the code wheel takes about one minute, and at a certain predetermined point in its travel corresponding to a definite period of time from the "start" impulse, the "operate" impulse is transmitted when the mechanical operation can be completed which will result in the switching of the contacts. Should the "operate" impulse take place at a time and point not corresponding to the preset adjustments of this relay, then it will not respond. Great ingenuity in design and many varied and complicated mechanisms have been put forward. None has found favour in this country, relay costs proving

Fig. 9. The main injection plant which includes the motor-alternator set.

very high. No definite protection from operating by surge potentials is evident.

Typical Installation

A description of an actual installation conveys perhaps the best impression of the implications and advantages of ripple control, and for this purpose the "Rythmatic" installation at Norwich has been chosen. The area controlled covers 750 square miles. The radial distances extend up to 20 miles, reaching to the coast.

The City of Norwich presents the greatest demand for lighting control in the county, and up to the present stage of development over 3,000 relays have been installed. The county is largely rural, with numerous small towns and villages, of which Wymondham, North Walsham and East Dereham, each with over 5,000 population, are the largest. There are 1,000 sub-stations, many being of the rural pole-mounting type. The control extends into the county and covers all the supplies fed from the 1,000 sub-stations. Several of the outlying communities have been equipped with the relays, and the consequent reduction of maintenance and operational duties is considerable.

A modern power-station supplies the area load of 40 mega-watts and exports up to a further 20 mega-watts to the "Grid." It is in this power-station at Thorpe that the plant is installed. Distribution to the county is at 33 kv. and 11 kv.; in the city 6.6 kv. distribution is used. Two separate small D.C. areas exist and the control is made effective in these by separate automatic injection.

The A.C. network is run in two separate sections. The injection and control is at Thorpe power-station. The signal current is applied firstly to No. 1 section and then to No. 2 section.

The actual signal train takes 15 seconds to transmit while the complete operating cycle for each of the two sections is one minute. A master time-switch sends the street-lighting signals out automatically. One of the two D.C. sections is energised simultaneously from a tapping off the main circuit; the other, being remote, picks up the signal locally and automatically reinjects the signal from a small local plant. The small reinjection plant for automatic reinjection of the signal at Duke Street is shown on Fig. 8.

Fig. 9 shows the main injection plant, including the motor-alternator set. The cabinet housing the ancillary automatic control plant appears in the foreground with the standby control desk.

The motor is of 50 h.p. and is of the squirrel cage inductor type. The alternator is of the inductor type, all windings being static, with complete absence of slip-rings, brushes, etc. It is started automatically and reaches full speed within 35 seconds.

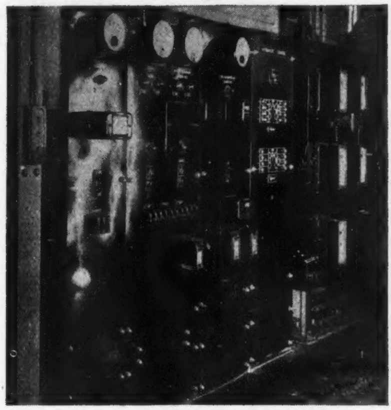
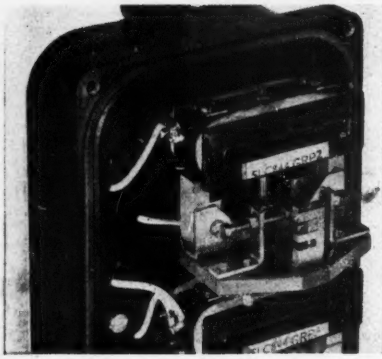


Fig. 10. The control panel.

The use of one frequency to provide all 12 signals enables this simple and rugged design of motor-alternator to be used. The need for accurate multi-frequency outputs is eliminated by the use of slow-speed (rhythm) impulsing. In lieu of using voice frequencies for signal discrimination, the mechanical resonator responds to differing "rhythms." Accuracy of rhythms is required, but is a very much simpler and economical proposition than providing accurate voice frequencies.

Isolation from the 11,000 volt bars is ensured by the specially designed transformer. This has star-delta windings, with the centre-point earthed on the high tension side. Normally there is a potential of 100 volts only on the local side of the coupling capacitor. The isolation transformer is provided to protect against fault conditions, particularly open-circuit faults with which high potentials would appear on the local side if this protective transformer were not provided.

The inductors are shown mounted over the capacitors on the superstucture specially provided. These are provided with laminated silicon—iron billets which enable induction values to be adjusted by virtue of their quantity and position in the core. Precise resonance is attained, with the capacitor, by the adjustment of these inductors. As but one voice frequency is used for the 12



signals, this problem of resonance is considerably simplified, as there is no need for accurate inductance taps and contactor switching to provide resonance at 12 different frequencies.

The capacitors are of standard power-factor-correction design, adapted to carry the superimposed signal frequency of 60 amps at 550 volts, 670 cycles. Single phase units of 5 mF capacity are used, and the 50-cycle feed-back current is 6 amps.

The impulsing of the output in the rhythm required by the particular signal to be transmitted is done by means of a contactor specially designed for high-speed operation. It functions in a shunt circuit to avoid the disadvantage of interrupting the circuit. Advantage is taken of the tuned resonant circuit so that, by switching this into an off-tune position, large powers are controlled by relatively small currents. A glance at Fig. 1, showing the injection circuit, will make this clear.

Control is effected at the control panel

Fig. 11 *(Left.)* Galvanometer relay.

Fig. 12 *(Below.)* Showing alternative methods of mounting the relays.

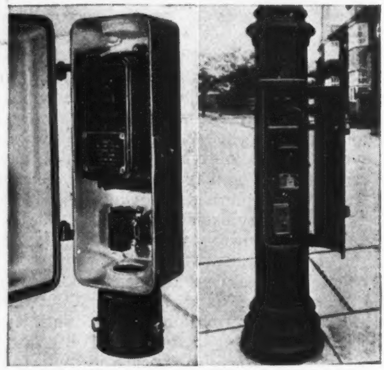
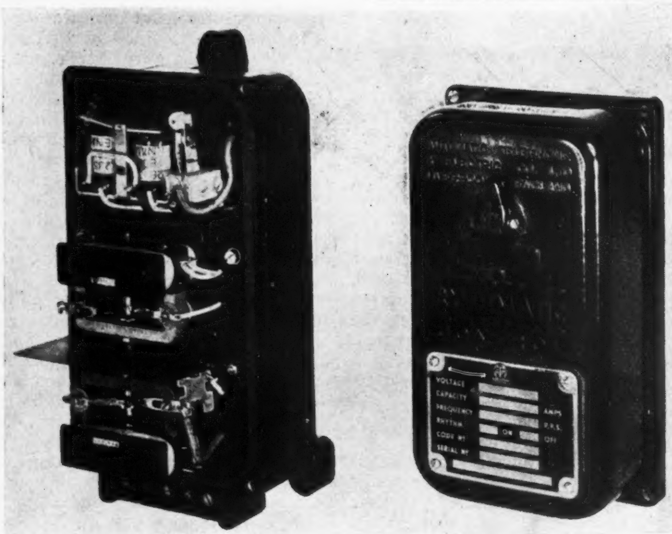


Fig. 13. The galvanometer relays and switching relay.



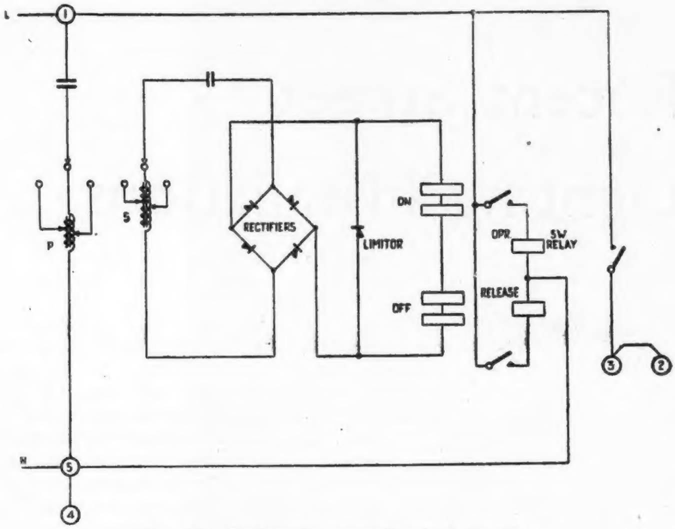


Fig. 14. Rythmatic control switch circuit.

shown in Fig. 10. For operation, the selector switch is turned towards the label of the desired signal and the "transmit" push button pressed momentarily. All operations follow automatically and take one minute for each of the two injections. The relays respond within 40 seconds, and a check back signal is given on this control panel.

Duplicate control equipment, separately fused, complete with standby control desk, is provided.

Fully automatic control is provided for the street light signals. A master time switch initiates each of the three signals used, namely, dusk, dawn, and midnight.

There are five signals allotted to "Load Shed," and these are controlled manually. These have proved invaluable in that they have enabled preselected loads of a non-essential character to be shed, and so have avoided the previous necessity of shedding large industrial users.

The rhythm is produced by means of a self-interrupting galvanometer unit which is independent of mains voltage and frequency. This is shown in Fig. 11. The control relays, etc., are mounted in the cabinet shown in Fig. 10.

Alternative methods of mounting the relays are shown in Fig. 12. It will be seen that a manual operation knob provides means of independent operation for lamp testing purposes.

The relay electrical filter, which converts the A.C. signal frequency impulses into D.C. impulses is mounted on the rear of the base plate shown in Fig. 13.

The galvanometer relays and switching relay are shown in Fig. 13. The top position "galvo" extends the "line" potential to the right-hand solenoid of the switching relay to attract the pivoted armature downwards. This causes the roller to move inwards and put into contact the two contact springs. The lower galvo energises the left-hand solenoid, which forces the armature against the roller, opens the contact springs, and overrides the centre line of the roller to lock in the "off" position.

A clear view of the galvanometer relay with armature, spiral spring, and contacts is given in Fig. 4.

Operation at Norwich has been very satisfactory. Figures taken over six months show that over a total of 3,167 relays installed, the fault incidence over total operations resulted in an operational efficiency of 99.986 per cent. The relay is designed to remain in service for years without any maintenance. Faults due to mishandling, etc., are corrected by the local staff. Extensions are proceeding with respect to both street lighting and load control.

Recent Street Lighting Installations

Wokingham

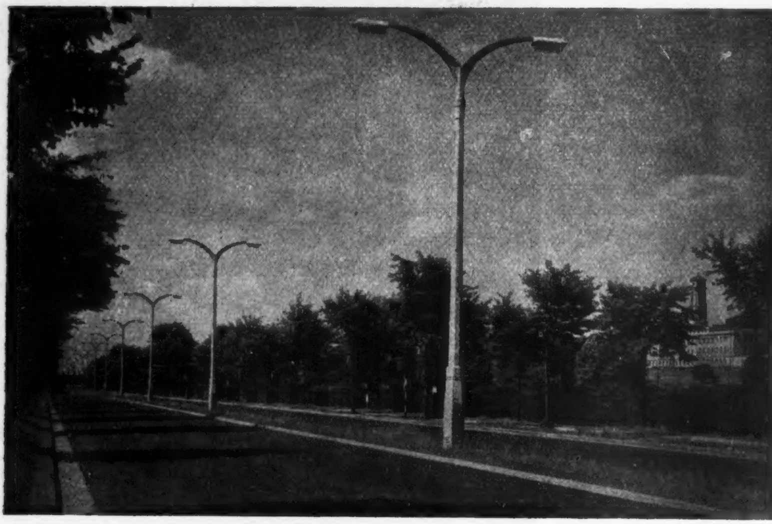
Wokingham Borough Council are now relighting the whole borough with sodium units over a period of years. Group " A " lighting has been adopted for all Class I and II roads, and Class III roads where road width and traffic density make this desirable. Other Class III roads and residential roads will be lit to Group "B" recommendations. The photograph illustrates one recently completed section for which "Golden Ray" lanterns supplied by the Engineering and Lighting Equipment Co. Ltd., using Philips SO/H. 140-watt sodium lamps, were mounted on columns supplied by Stanton Ironworks Co., in a special buff finish to blend with the old houses in the borough. The erection and wiring were carried out by Erecon Ltd., and the lamps are controlled by Sangamo Weston time switches.

Nantwich

The adjacent photograph shows the High Street, Nantwich which is lighted by Revo " Sol-etern " lanterns using two 80-watt 5-ft. fluorescent lamps. It illustrates the good results which can be obtained in shopping centres with this type of lighting. Revo " Sol-etern " lanterns are also manufactured for use with three and four 80-watt 5-ft. fluorescent lamps and the Baby " Sol-etern," which is a smaller pattern, is also supplied for Group " B " roads. This fitting may have two 20-watt 2-ft. lamps or two 40-watt 2-ft. lamps, as required.

Litherland

A new installation of Siemens' 140-watt sodium vapour lamps has recently been completed at Church Road, Litherland, Liverpool. The lanterns used for lighting both the single and dual carriageways are Siemens' Sola Sieray single plate refractor type. A total of 68 are mounted on Concrete Utilities' "Avenue 3DN " 25-ft. columns. The average spacing of the columns is 120 feet and the illumination per 100 ft. linear is approximately 5,500 lumens.



Nottingham

Installation shown above is of Metropolitan-Vickers "S.O. Fifty" lanterns mounted on Stanton Spun Concrete lighting columns at University Boulevard, Nottingham.

Hyde Park

Installation of Suggs Group "B" Southport lanterns in East Carriage Drive, Hyde Park.

Correspondence

Home Lighting

To the Editor of LIGHT AND LIGHTING.

Sir,—In your July issue there is a very interesting letter on the subject of Home Lighting. Reading through it, I was staggered to see that the writer of same has a total of 300 watts to light his kitchen. That means a possible total of 3,885 lumens, using single coil G.L.S. lamps, but if we allow, say, 15 per cent. for absorption in the glass, that leaves a possible total of 3,302 lumens.

Of course, I have no idea of your correspondent's kitchen, but I have in my kitchen, of 10 x 11 ft. by 11 ft. 6 in. high, one 40-watt fluorescent 3,500 deg. lamp on a channel unit attached direct to the ceiling, giving approximately 2,100 lumens for 46 watts, compared with 3,302 lumens for 300 watts.

Since I put in the single channel unit, I have noted that one can see much better in the corners and that the difference in colour-rendering quality is so slight as to be not worth bothering about.

Bathrooms in this country are rapidly going over to fluorescent lamps, and local architects and builders now leave space over the mirror-locker for the installation of a 20-watt fluorescent lamp. As most women make-up in their bedrooms in front of the dressing table, once again the slight colour difference in the bathroom is of little importance.

As your correspondent says in his last paragraph, we shall get more response from the public if we advocate simpler forms of good lighting.—Your, etc.

NEVILLE J. PINSENT.

Buenos Aires.

SITUATION VACANT

Wanted. TECHNICIAN to develop designs of interior lighting equipment for public service vehicles. Thorough knowledge of elementary optics essential. Applicant must be capable of discussing problems with customers and designing products to meet requirements technically and economically. Applicants should reply giving full details, age, experience, and qualifications.—Box No. 810.

I.E.S. ACTIVITIES

Mr. Davies' Presidential Address

At the opening sessional meeting in London on October 10, Mr. L. J. Davies was inducted as President for the session 1950-51. For his presidential address, Mr. Davies dealt with the subject of research, technological progress, and illumination.

One is accustomed, said Mr. Davies, to hear illumination referred to as a science and an art but seldom as one of the technologies. A technology may be briefly defined as "the science of an industrial art": illumination is made up of a number of industrial arts, lamp making, glass manufacture, fittings design, many of which have their own technologies. There is, however, an overall technology of illumination, and it is of value to the Society that it should consider technological progress from its own particular point of view.

Technological advances arise out of research, development, engineering, production, and utilisation. Research cannot be isolated in this respect and must be appreciated and utilised by all who work on illumination matters—not all research needs to be carried out in a laboratory and valuable contributions can be made as suggested by Mr. Davies in the latter part of his address.

Sir Edward Appleton has suggested that research may conveniently be divided into three groups: fundamental research, objective fundamental research, and applied research.

Fundamental research is that which is done to add to the world's knowledge whatever the final outcome or consequences may be. Such research may appear to have little bearing on our every day lives, and it may be some time before the results of such work have any practical application. There may be what would seem to be obvious fields for such research. For instance, in the lighting field we are always on the lookout for a new light source which is more efficient, giving good colour and long life, and having no starting or running difficulties. This may seem to be a good field for fundamental research but there is a dilemma. Present-day light sources are based either on combustion, incandescence, luminescence of discharges and arcs, or fluorescence. Combustion and incandescence came to us from earliest times and fluorescence was noted in the Middle Ages. For the applied research people, those who work in the lamp research laboratories, to make a really new light source requires a fundamental discovery; such is not likely to be discovered by an amateur. Nor, indeed, is the discovery very likely to be made by a deliberate research, but there is a chance that one may arise out of the many and varied researches into basic knowledge.

Objective fundamental research is basic inquiry into matters which are known to have a potential application. There are many cases the direct impact of which on illuminating engineering can be clearly appreciated as, for example, with glass, a substance essential to our technology. Glass has been known and used for a very long time, yet objective work is going on most actively to explain and improve its behaviour under various circumstances.

There are many such fields of objective research, and it is clear that members of the I.E.S. are concerned remotely in some cases and by direct contact in others, and thus draw upon a vast array of scientific effort.

It is in applied research that work closer to the illuminating engineer is done, and quite a few members of the Society are directly engaged in it. It takes known results and seeks to apply them to achieve a practical objective. An example of this is the fluorescent lamp—by application of applied research virtually a new lamp was created, which, in itself, contains nothing that was not already known. Existing knowledge of the behaviour and properties of glass, fluorescent powders, discharge through mercury vapour, coated cathodes, etc., were separately known before an efficient mains voltage lamp was made, but it required invention to combine them and applied research to work out the principles of design so that development of a high efficiency and practical production article was possible.

After applied research has shown whether or not an objective can be reached, the extent to which success can be achieved depends on the manufacturers, designers, lighting engineers, etc. Their judgment will already have played a part in initiating the applied research, and their experience will lead to further developments and applications.

Mr. Davies suggested that there were opportunities for lighting engineers to carry out their own research into matters of great importance to the industry. There was, for example, the matter of the life of lamps. Though extensive tests are carried out at the factories, details of the life of lamps under service conditions could often be of great value.

A most important avenue of research is the assessment of the tangible benefits of improved lighting. We are all convinced of these benefits; we are certain that if one

takes a poorly lighted production area and installs up-to-date lighting equipment, raising the level of illumination from, say, 5 to 20 lm./ft.^{2}, reducing the glare, etc., the results will be worth while. But though this is frequently done, statistics are too seldom kept; how valuable this information could be. This is filed work on which a research outlook is required. Changes in lighting are often made at the same time as rearrangements of the work area, tooling-up for new production, etc., so that definite conclusions are not always possible. But where the only significant change is the lighting installation then in co-operation with the factory management the lighting engineer should be able to compile very useful records.

Other similar instances of research were mentioned by Mr. Davies, including such items as lighting and colour in offices and lighting for viewing television in the home. The aim, said Mr. Davies, should be to try it for oneself, to be inquisitive into such matters, and to cultivate the research outlook.

In conclusion, Mr. Davies said he had endeavoured to indicate that research fits into a pattern in which the various types of research merge progressively with engineering, manufacture, installation and distribution, but that it can only be fully effective if members of all groups give it proper regard. There were, he repeated, plenty of opportunities in illuminating engineering for anyone to indulge sufficiently in investigation to become truly research minded, which would be a true help to the technological progress of illumination.

Forthcoming I.E.S. Meetings

LONDON

November 14th
Sessional Meeting. "The Lighting of the House of Commons," by C. Dykes-Brown. (At the Lighting Service Bureau, 2, Savoy Hill, W.C.2) 6 p.m.

December 12th
"The Development of the Tungsten Lamp," by B. P. Dudding. (At the Lighting Service Bureau, 2, Savoy Hill, W.C.2.) 6 p.m.

CENTRES AND GROUPS

November 1st
"The Problems Associated with Underground Lighting in British Coal Mines," by D. A. Strachan. (At the Minor Durrant Hall, Oxford Street, Newcastle-on-Tyne, 1.) 6.15 p.m.

November 1st
Film Evening. (At 4, Northampton Gardens, Swansea.) 5.45 p.m.

November 2nd
Demonstration and Display of New Lighting Equipment. (At the Midland Electricity Board Demonstration Room, 21, Paradise Street, Birmingham, 1.) 6 p.m.

November 2nd
Film Evening. (At the South Wales Electricity Board Demonstration Theatre, The Hayes, Cardiff.) 5.45 p.m.

November 2nd
"Application of Fluorescent Lamps to Street Lighting," by N. W. Wood. (At the Agricultural House, Queen Street, Exeter.) 7 p.m.

November 3rd
"Application of Fluorescent Lamps to Street Lighting," by N. W. Wood. (At the South Western Electricity Board Showrooms, Bath.) 7 p.m.

November 3rd
"Colour," by Dr. W. J. Wellwood-Ferguson. (At the Electricity Showrooms, Market Street, Huddersfield.) 7.15 p.m.

November 6th
Brains Trust. (At the Lighting Service Bureau, 24, Aire Street, Leeds, 1.) 7 p.m.

November 6th
"Floodlighting," by R. O. Ackerley. (At the Lecture Theatre, Merseyside and North Wales Electricity Board's Service Centre, Whitechapel, Liverpool, 1.) 6 p.m.

November 6th
To be announced later. (At the Medical Library, The University, Weston Bank, Sheffield, 10.) 6 p.m.

November 8th
"Lighting of Architecture," by G. Grenfell Baines. (At the Welfare Club Hall of the City of Edinburgh Lighting and Cleansing Department, High Street, Edinburgh.) 7 p.m.

November 9th
Ladies' Night. (At the Imperial Hotel, Temple Street, Birmingham.) 6 p.m.

November 9th
"Lighting of Architecture," by G. Grenfell Baines. (At the Institution of Engineers and Shipbuilders, 39, Elmbank Crescent, Glasgow, C.2.) 6 p.m.

November 9th
"Some Aspects of Colour in Relation to Discharge Lamps," by A. E. Bird. (At the Demonstration Theatre, East Midlands Electricity Board, Leicester Sub-Area, Charles Street, Leicester.) 6.30 p.m.

November 9th
"Lighting in the New House of Commons," by Veronica Demuth. (Joint Meeting with the School of Architecture, Manchester University.) (At the Reynolds Hall, Manchester College of Technology, Sackville Street, Manchester, 1.) 6 p.m.

November 14th
"Care and Maintenance of Fluorescent Lamps," by A. G. Mitchell. (At 31, Kingsway, Stoke-on-Trent.) 6 p.m.

November 15th
"Radiation Light and Illumination," by Dr. J. N. Aldington. (At the Albion Hall, Central Y.M.C.A. Buildings, Albion Place, Leeds, 1.) 7 p.m.

November 15th
"Floodlight Practice," by M. W. Peirce. (At the Cleveland Scientific and Technical Institution, Corporation Road, Middlesbrough.)

November 16th
"Lighting in the Home," by Miss M. Wardlaw. (At the Cadena Cafe, High Street, Cheltenham.) 6.30 p.m.

November 16th
Manchester Centre Dance. (At the Plaza Ballroom, Manchester.)

November 23rd
"Lighting in the Home," by Miss M. Wardlaw. (At the Yorkshire Electricity Board, 45/53, Sunbridge Road, Bradford.) 7.30 p.m.

November 30th
Presidential Address by L. J. Davies. (At the Gas Showrooms, Parliament Street, Nottingham.) 5.30 p.m.

November 30th
"Lighting in the Home," by Miss M. Wardlaw. (At the Agricultural House, Queen Street, Exeter.) 7 p.m.

December 1st
"Lighting in the Home," by Miss M. Wardlaw. (At the Grand Hotel, Bristol.) 7 p.m.

December 1st
"Floodlighting," by R. O. Ackerley. (At the Imperial Hotel, Temple Street, Birmingham.) 6 p.m.

December 1st
"Illuminated Signs and Display with Discharge Tubes," by C. Higgins. (At the Electricity Showrooms, Market Street, Huddersfield.) 7.15 p.m.

December 4th
"Light and the Eye," by Dr. W. J. Wellwood-Ferguson. (Joint Meeting with the Yorkshire Optical Society.) (At the Lighting Service Bureau, 24, Aire Street, Leeds, 1.) 7 p.m.

POSTSCRIPT

By "Lumeritas"

My references last month to "The Times" correspondent on the subject of ugly lamp-posts have prompted a correspondent to express the opinion that the newest lanterns for electric street lighting have more aesthetic merit than the newest posts designed to carry them. This may be so, though in the case of fluorescent tube street lanterns I wonder whether a majority of people would agree with my correspondent. It is not easy to make a 25-foot lighting column "a thing of beauty and a joy for ever." Its height makes it more conspicuous than the lamp "posts" of yesteryear, and on this account alone it may be out of character with its setting as, indeed, one of the writers to "The Times" pointed out.

Colour rendering in the light of the mercury and sodium discharge lamps used for street lighting came in for some comment at the recent A.P.L.E. conference. This is a matter which, like the design of street furniture, ought to be considered with reference to the environment. During the summer (?) I visited several of our seaside resorts, each of them differently lighted along the seafront. Judged on the score of visibility, the best lighting was at a Cornish resort having an excellent installation of mercury discharge lamps. Nevertheless, I liked it least; it seemed cold and inhospitable and somehow out of place. Possibly, if the weather had been hot and sultry the "coldness" of the light would have been less repellent but, even so, I am sure I would have thought mercury lighting inappropriate to the environment.

The emotional effects associated with the lighting of different environments are much more important than many lighting engineers realise. I have recently seen several efficient office and factory installations, giving physiologically satisfactory lighting, which have failed to satisfy the occupants, because the installations have been too intrusive and have degraded an environment which needed and might have received enhancement by a more suitable lighting scheme.

This aspect of the suitability of lighting is not one with which the lighting engineer can deal according to easily formulated rules of practice. Certainly, it is not only, not always, a matter of aesthetics. Having occasion recently to visit the office of a solicitor, I found a fluorescent installation in his general office which is neither aesthetically meritorious nor congruent with the interior, yet it is quite acceptable. The interior is Dickensian in period, and possibly, too, the first undercoat of the dust on some of the clients' racked dossiers settled there in Dickens's time! Bob Cratchit would surely find it hard to believe that his office had not been translated to the celestial sphere could he see what lighting has replaced that of his guttering candle! It is entirely out of character, yet it is satisfying.

As the days shorten, those of my readers, or their acquaintances, who possess television receivers will doubtless spend more time "looking in" than during the summer months. I hope none of them will do so with all room lighting extinguished, because this is unnecessary and, in my experience, is tiring to the eyes. I find it quite satisfactory to keep two judiciously placed floor standard lamps alight and, if a transparent tinted screen is placed in front of the cathode ray tube, a central pendant 200-watt lighting unit can also be kept alight without spoiling the picture.

A certain amount of alarm, if not of despondency, seems to have been caused by the publication in an American medical journal of an article reporting a few cases of "cutaneous burns due to fluorescent lighting." I have read the article in full and the "cutaneous burns" turn out to be mild reddening of the skin, similar to sunburning, such as not a few people look forward to getting on their summer holiday. Moreover, I am told that independent efforts over here to produce such "burns" by close exposure to fluorescent lamps have failed, in spite of a more severe dosage. The author of the article in question searched the medical literature for any other reports of such cases but found only two. Having regard to the very large number of people now "exposed to risk," the number of reported cases of skin reddening *alleged* to be due to fluorescent radiations is negligibly small. If I were seeking a "racket" by which to get rich quickly I doubt if I could do better than underwrite the risk of "cutaneous burns due to fluorescent lighting" for a few pence per person per annum!

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